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WARZYN

Plan
Project No. 60251

Health and Safety Plan
Remedial Investigation/
Feasibiliy Study
American Chemical Services, Inc.
Griffith, Indiana

Prepared for:

American Chemical Services
Steering Committee
Chicago, Illinois

Prepared by:

Warzyn Engineering Inc.
Chicago, Illinois

May 1989

SITE HEALTH AND SAFETY PLAN
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

AMERICAN CHEMICAL SERVICES
GRIFFITH, INDIANA

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PROJECT NO. 60251

May 18, 1989

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1.0 INTRODUCTION

The objective of this plan is the accomplishment of necessary on-site remedial investigation field work to achieve the objectives of the Remedial Investigation/Feasibility Study in a manner which minimizes any potential for accident, and which is adequately protective of the environment and of the health of project workers. In order to achieve these goals, all of the operations conducted at this site will be in accordance with the requirements of the Hazardous Waste Operations and Emergency Response Standard, OSHA 29 CFR 1910.120, and with all of the applicable subparts of the OSHA Construction and General Industry Standards, 29 CFR 1926. these subparts include Subpart C, - General Safety and Health Provisions, Subpart D, - Occupational Health and Environmental Controls, Subpart E, - Personal Protective and Life Saving Equipment, Subpart F - Fire Protection and Prevention, Subpart G - Signs, Signals and Barricades, Subpart I - Tools - Hand Power, Subpart K - Electrical, Subpart L - Ladders and Scaffolding, Subpart O - Motor Vehicles, Mechanized Equipment and Marine Operations and Subpart P - Excavations Trenching and Shoring of the OSHA Construction Standards. Additional OSHA Construction and General Industry Standards may apply, depending on the nature of the operations which might evolve on the site during the course of the Remedial Investigation and Feasibility Study.

2.0 SITE SUMMARY

2.1 Site History

The ACS site is located at 420 South Colfax Avenue, 1/2 mile southeast of Griffith, Indiana, in the northwest 1/4 of the southeast 1/4, Section 2, Township 35 North, Range 9 West, Lake County Indiana (Figure 1). Although the site name is ACS, the United States Environmental Protection Agency (U.S. EPA) has defined the site as including the inactive portion of the 31-acre Griffith Landfill, the 2-acre Pazmey Corporation site (formerly Kapica Drum, Inc.), and the ACS property (19 acres).

There are railroad tracks bordering the study area on the north, south, and west, and tracks also bisect the study area in a NW-SE direction. The topography at the site is almost level in the portion north of the railroad and rises slowly from 630 to 645 feet MSL in the southern half of the site. A marsh to the north of the landfill and west of the ACS property has a surface elevation of about 625 feet MSL. Surface water channels exist north and south of the marsh. A small pond is located on the ACS property. There are numerous buildings and tanks located on the ACS property, and the Pazmey property. Trees are growing west and south of the ACS property.

On the ACS property is an active hazardous waste storage and treatment facility operating under RCRA interim status. From 1955 to at least 1975, ACS disposed of hazardous wastes on its property, primarily from on-site chemical manufacturing and solvent reclamation operations. Some wastes were accepted from off-site sources for incineration in the ACS on-site incinerator. The incinerator-generated ash was then disposed of on ACS property.

The Griffith Landfill is an active sanitary landfill operation. About five acres on the southern portion of the study area are active disposal areas. Inactive portions were reported to have received hazardous wastes from ACS and Kapica Drum, Inc. prior to RCRA. Kapica Drum Inc. was a drum reconditioning facility which generated drum residues and rinse water from cleaning drums that contained hazardous wastes. Figure 2 summarizes the interrelationship between ACS, Kapica Drum, Inc., and the Griffith Landfill based on a review of available information. For a more detailed site history, refer to the ACS Initial Site Evaluation Report (document number 160-WP1-RT-AUJD-1).

The objective of the Remedial Investigation/Feasibility Study (RI/FS) is to evaluate the existence and magnitude of contamination, and recommend a cost effective, viable remedial action alternative(s) for mitigating any hazard posed by the site. The RI/FS will be performed to gather and assess information needed to accomplish the following objectives:

- Determining if the ACS site poses a risk to public health, welfare, or the environment.
- Determining the characteristics, extent and magnitude of contamination at the site.
- Defining the pathways of contaminant migration from the site.
- Defining on-site physical features and facilities that could affect contaminant migration, containment, or cleanup.
- Developing viable remedial action alternatives.
- Evaluating and screening remedial action alternatives.
- Recommending the cost-effective remedial action alternative which adequately protects health, welfare and the environment.

All tasks, subtasks, and activities are directed toward the accomplishment of these primary objectives.

Under the Superfund Amendments and Reauthorization Act of 1986 (SARA), it is recommended that the RI/FS are integrated so that parts of each are conducted concurrently. Therefore, the project will be designed to make optimal use of information as it is derived and to produce the information which is necessary to complete the FS. Because this approach makes use of the most current information, data overlaps and data gaps are minimized. The phased approach allows "mid-course" corrections to be made so that the investigation will development in the most efficient and cost-effective sequence.

The remedial investigation field work will result in the collection of 68 source characterization samples from the documented and suspected waste burial and soil contamination areas at the site. In addition, 187 site characterization samples (groundwater, surface water, sediment, private well and geotechnical) will be collected during the remedial investigation field work.

The feasibility study will include the initial screening of candidate remedial alternatives and subsequent detailed evaluation of selected alternatives. Technical, environmental, economic, and institutional criteria will be utilized to perform the alternative evaluations. A conceptual design and associated cost estimates will be prepared for the recommended remedial strategy.

2.2 Waste Disposed of at the Site

Based on available information there are four documented waste burial locations, one suspected waste burial location and four suspected contaminated soil areas. Figure 3 shows the locations of each of these areas, and Table 1 summarizes the corresponding waste types.

2.3 Discussion of Contaminants

Samples collected prior to this investigation indicate contaminants are present in the groundwater, surface water (or leachate), and soils. Results from analysis of samples from the existing groundwater well system indicate the presence of organic compounds such as benzene, toluene, vinyl chloride, trichloroethylene, phenol and pentachlorophenol. Soil/sediment analysis have indicated the presence of benzene, toluene, naphthalene, phthalate esters, phenanthrene and anthracene. Ponded surface water/leachate have also shown the presence of naphthalene, phthalate esters, phenols, and (2-ethoxy) acetate, plus metals (cadmium, lead, chromium, nickel, mercury) and cyanide.

3.0 HAZARD EVALUATION

3.1 Substances of Concern

A wide variety of potential substances of concern have been identified at the ACS Site. The following discussion highlights those chemicals, chemical groups, and materials which appear to pose the greatest health and safety concerns. These are discussed in relation to the matrix (i.e. soils, surface water, sediment, groundwater) in which they occur. All sample matrices indicate contamination to some extent.

Tables 2, 3 and 4 outline the highest value for compounds or elements found in the matrices (i.e. groundwater, soil or leachate/sample water).

3.2 Health and Safety Related to Substances of Concern

Because the number of individual organic and inorganic chemicals and compounds is so extensive, it would be excessive to discuss each one individually. Therefore, they are discussed below as groups or classes. Refer to Attachment A for definition of terms and acronyms.

Polynuclear Aromatic Hydrocarbons (PAH's)

This group includes a great number of chemical compounds which are common in our environment and vary widely in their potential impact on human health. Some of the most powerful carcinogens are PAH's. Most PAH's occur in the environment as complex mixtures which consist of both carcinogenic and non-carcinogenic PAH's. The toxic effect of PAH's through absorption (by way of inhalation, ingestion, or dermal contact) appears to be based on a high level of exposure over a relatively long time period.

Halogenated Hydrocarbons

These compounds are highly mobile, migrating easily through water, air, and soil. They are persistent in the underground environment, although they may degrade at the surface under the influence of ultra-violet light.

Halogenated hydrocarbons may act on the central nervous system, either as a stimulant or depressant. Mild exposure may cause such symptoms as dizziness, nausea, abdominal pain, and vomiting. In chronic (long-term) exposure, loss of weight and appetite may occur. Moderately severe exposure presents those symptoms given above followed by severe irritability, convulsive seizures, and coma.

Compounds from this class of chemicals detected as the site include:

1,2-Dichloroethene - a colorless, volatile liquid with a pleasant odor. Used as a solvent in perfumes, lacquers, thermoplastics, and organic synthesis. Produces drowsiness and effects the central nervous system. ACGIH recommends a TLV of 200 ppm. No STEL is recommended.

1,1,1-Trichloroethane (Methyl Chloroform) - a clear, non-flammable liquid used primarily as a cleaning solvent. It may affect the gastrointestional tract and the central nervous system. May cause anesthesia and death at high concentration (14,000-15,000 ppm). Lower concentration exposures, repeated daily, do not generally produce significant health effects. ACGIH recommends a TLV of 350 ppm to prevent beginning anesthetic effects and objections to odor. A STEL of 450 ppm is recommended for protection against anesthesia. Odor threshold is 100 ppm.

Trichloreoethylene (TCE) - a colorless, non-flammable liquid with a sweet odor like chloroform. Can be adsorbed through the skin. Inhalation and ingestion are also routes of exposure. Symptoms of exposure include headaches, dizziness, disturbed vision, nausea, vomiting, and eye irritation. Fatalities have occurred following severe, acute exposures. It has been known to cause cancer in laboratory animals. ACGIH recommends a TLV of 50 ppm. Odor threshold is also 50 ppm.

Vinyl Chloride - an easily liquefied gas with a faintly sweet odor. It may affect the central nervous system, liver, respiratory system and lymphatic system. It is a known carcinogen. The ACGIH recommends a TLV of 5 ppm.

Methylene Chloride - as a pure product, methylene chloride is a colorless liquid with a chloroform-like odor (pleasant to sweet odor). With a vapor pressure of 350 mm and a boiling point of 104°F, methylene chloride volatilizes at standard or elevated temperatures.

Methylene chloride inhalation can induce narcosis, affect the central nervous system and blood, cause nausea, dermatitis, numbness or tingling of the extremities, and accelerated pulse rate.

Skin contact may cause irritation of the skin and/or eyes. Exposure to high concentrations may produce vertigo and angina. Primary routes of exposure include inhalation, ingestion and skin or eye contact. Although methylene chloride has produces tumors and cancer in laboratory animals, it is currently not classifiable in reference to human carcinogenicity. The recommended TLV for methylene chloride is 50 ppm, while the PEL is 500 ppm.

Light Aromatic Hydrocarbons

Compounds in this group are highly volatile, moderately soluble, biodegradable, and only slightly adsorbed on soils and sediments. Their presence at the surface is based on volatilization rates and biodegradation activities. In the groundwater environment, they are persistent and mobile. Exposure to these substances is primarily through vapor inhalation, although absorption through the skin may also readily occur. Acute exposure poses the primary health hazard of these substances. Low level exposure may result in irritability, excitability, muscle tremor, and headache. Some of the more notable light aromatic compounds which are present include ethyl benzene, xylene, and toluene.

Ethylbenzene - colorless, flammable liquid with aromatic odor. Explosive limits of 1% to 6.7% by volume in air. Toxicity is characterized by irritancy to skin and, to less extent, mucous membranes.

5,000 ppm - intolerable irritation

2,000 ppm - IDLH, immediate and severe eye irritation and moderate nasal irritation.

1,000 ppm - irritation and tearing of eyes, tolerance develops rapidly.

200 ppm - moderate and occasional eye irritation.

Low acute toxicity. TLV = 100 ppm. STEL = 125 ppm.

Prolonged exposure may cause chest constriction leading to congestion of the brain and lungs with edema.

Xylene - clear, flammable liquid with aromatic hydrocarbon odor. Exposure symptoms include headache, eye irritation, fatigue, irritability, nausea, and anorexia. Chronic exposure may result in injury to heart, liver, and/or kidneys.

TLV = 100 ppm. STEL = 150 ppm. NIOSH recommends TWA of 100 ppm and 10 minute ceiling of 200 ppm.

Toluene - flammable, colorless liquid with aromatic hydrocarbon odor. Explosive limits of 1.3% and 7.1% by volume in air.

500 to 1,500 ppm - heart palpitation, extreme weakness, loss of coordination.

200 to 500 ppm - impairment of coordination, momentary loss of memory.

Less than 200 ppm - headache, lassitude, nausea

TLV = 100 ppm. STEL = 150 ppm.

Prolonged exposure has acted as a mutagen in experimental animals.

Phenol

Phenol is a solid or liquid with sweet tarry odor similar to railroad ties. Explosive limits 1.7% to 8.6% by volume in air. Exposure symptoms - will burn eyes and skin and it acts as a poison on the central nervous system. The analgesic action may cause loss of pain sensation. Prolonged exposure has acted as a carcinogen and mutagen in experimental animals. TLV = 5 ppm. IDLH = 100 ppm.

PCBs

These compounds are readily absorbed through the skin and permeate most protective clothing within a relatively short time period. Exposure to PCBs may cause chloracne (a reddish eruption of the skin), irritation of the

respiratory system, and liver damage. PCBs have been shown to cause birth defects in developing fetuses and are suspected of carcinogenic activity. The members of this group have low vapor pressures and thus do not volatilized quickly. The greatest threat of exposure comes from direct contact with contaminated soils and waters, or by inhalation of contaminated dusts or aerosols. The OSHA standard for PCB is 0.5 mg/cubic meter (54% chlorine) and 1 mg/cubic meter (42% chlorine), while NIOSH recommends an 8-hour TWA of 0.001 mg/cubic meter for all PCBs.

Heavy Metals

Heavy metals may become absorbed onto soil particles and therefore are of concern if dry, dusty conditions prevail. Lead has a Permissible Exposure Limit (PEL) of 0.05 mg/cubic meter. Chronic overexposure may case brain damage, gastrointestional disturbances, anemia, and kidney damage.

Ingestion or inhalation of chromium may lead to histologic fibrosis of the lungs. The TLV for chromium is 0.05 mg/cubic meter, and the IDLH Level is 500 mg/cubic meter. Minimum tolerance (less than 30 minutes) is 0.025 mg/cubic meter. Recommended TLV = 0.002 mg/meter. This element is also a suspected carcinogen. Chromium poses a potential health risk by inhalation, ingestion, or skin absorption. Its allowable airborne concentration has been established at 0.5 milligrams per cubic meter of air. Exposure to chromium may cause an allergic type reaction producing dermatitis or lung irritation. Symptoms of exposure may include coughing, wheezing, headaches, difficult breathing, and fever. The skin may become red, inflamed, itch, and ulceration may occur.

Nickel and soluble nickel compounds are capable of producing sensitization dermatitis and/or allergic asthma in certain individuals. Furthermore, inhalation of many nickel compounds via their presence on airborne dusts can produce severe irritation of the nasal cavities and pneumonitis. Some of these compounds have been proved to be cancer producing in humans via inhalation. Care should be taken to prevent any skin contact with and/or inhalation of dusts containing such compounds. The TLV for soluble compounds of nickel is 0.1 mg/m^3, while the TLV for nickel or its insoluble compounds is 1 mg/m^3.

Cadmium compounds are possible human carcinogens with high oral and inhalation toxicities. The inhalation of dusts containing such compounds primarily affects the respiratory tract, but the kidneys and liver may also be affected with exposures to high concentrations. Possible symptoms of

exposure include pulmonary edema, dryness of the throat, cough, headache, shortness of breath, and vomiting. More severe exposures result in marked lung changes, persistent cough, pain in chest, severe dyspnea, prostration with possible fatal results. Ingestion of cadmium compounds may result in sudden nausea, salivation, vomiting, diarrhea, and abdominal pain and discomfort. The TLV for cadmium is 0.05 mg/m^3, while the current PEL is 0.2 mg/m^3.

Cyanide

Most cyanide compounds and hydrogen cyanide (HCN) gas can be readily absorbed through the skin. Inhalation of HCN or dust of cyanide compounds and ingestion of cyanide compounds are also a route of entry. Skin absorption is accelerated by sweating and the presence of open wounds. Once cyanide has entered the body, it acts as a very rapid acting blood poison interrupting the transport of oxygen.

Cyanide and cyanide compounds are mainly of concern in regard to the respiratory dangers they present. Hydrogen cyanide gas and volatile cyanides are all highly toxic by brief, high level exposures and can cause death. Cyanide is a noncumulative poison, and therefore chronic toxicity is not a major concern. Acute exposure to hydrogen cyanide may result in symptoms such as headache, weakness, changes in taste and smell, irritation of throat, vomiting, difficulty breathing, abdominal colic, and nervous instability. Hydrogen cyanide has the characteristic faint odor of bitter almond. The TLV for cyanide and cyanogens is 10 ppm.

3.3 Health and Safety Hazards Related to On-Site Activities

Drilling operations will pose those physical threats normally associated with drilling. Typical hazards associated with drilling include: falling objects, fueling engines, rotary equipment, cables, ropes, derricks, overhead powerlines, and lightning. Personnel should stay away from the drilling operations unless their presence is necessary to perform their duties. Hardhats, safety glasses and steel-toe shoes are appropriate for personnel working near rig. A face shield may be appropriate depending upon the potential for splash. In addition, the possibility of respiratory and dermal contact with contaminants will also be prominent during these activities.

3.4 General On-Site First Aid

The following discusses general on-site First Aid procedures for exposure to contaminants on-site:

- Contaminated Materials In Eyes - wash with copious amounts of water for at least 15 minutes. Lift upper and lower lids occasionally. Seek medical attention immediately. (Eye wash will be available at on-site work area.)

- Contaminated Materials Contact Skin - promptly wash area with soap or mild detergent and water. Flush well with water. Check for signs of skin irritation. Seek medical attention if unusual appearance of skin or sensation is noted.

- Contaminated Materials Penetrate Protective Clothing - discard protective clothing and underlying clothing. Wash skin as described above. Confer with Site Safety Officer in selection of new protective clothing.

- Inhalation of Contaminated Air - move person to well ventilated area at once. If individual is not noticeably effected, and has no side affects after about 15 minutes, returning to work is allowed providing the work area is no longer contaminated. If individual has not fully recovered, continue to monitor for an additional 15 - 20 minutes and seek medical attention if necessary. Use artificial respiration if breathing has stopped. In such instances, seek medical attention after victim has resumed breathing. If possible, have someone seek medical attention while person is being resuscitated.

- Ingestion of Contaminated Materials - flush mouth with water, being careful not to swallow. Contact local poison center (see telephone number in Emergency Response and Information section). When called for, induce vomiting by physical means or with Syrup of Ipecac (**DO NOT** induce vomiting in unconscious persons). Seek medical attention promptly.

If, at any time, personnel feel fatigued, dizzy, nauseous, or experience headache, they should be moved to a well ventilated area and allowed to rest for 15 to 30 minutes. If symptoms do not subside, seek medical attention.

The wearing of contact lenses will not be allowed when respirators are worn.

Other emergency equipment and its location is presented in Section 10 - Emergency Response and Information.

3.5 Qualifications and Responsibilities of Site Safety Officer and On-Site Personnel

The Site Safety Officer (SSO) shall receive or will have completed the following training:

- Hazardous Waste Site Investigation Training Program (Warzyn's in-house training program or equivalent),
- Respiratory Protection Training, and
- Air Monitoring Equipment Training.

When Level B is to be used, a Site Safety Officer skilled in the set-up and use of air supply systems (cascade system, air-supply hose manifold, tank recharging, etc.) will be on-site. Any anticipated level B work necessitates the presence of a back-up person with quick access to a second SCBA.

The Site Safety Officer will be responsible for instructing the work team in the Site Health and Safety Plan and in supervising the implementation of the plan on-site. The SSO will be responsible for personnel and environmental monitoring, including maintenance of air quality monitoring equipment.

Specific responsibilities include:

- Thoroughly understanding the site work plan,
- Verifying that site personnel have received proper training and participate in medical surveillance program,
- Verifying that site personnel have appropriate safety equipment,

- Establishing work and decontamination zones,
- Performing or supervising ambient air quality monitoring as needed during drilling and other activities,
- Modifying Site Health and Safety Plan as needed and notifying appropriate personnel of changes,
- Notifying State and local agencies of any contaminant releases (See Section 10 - Emergency Response and Information Section).
- Maintaining and using (as necessary) emergency equipment (See Section 10 - Emergency Response and Information Section).

The Site Safety Officer will have the authority and responsibility to shut down operations, if necessary.

All personnel are responsible for understanding and complying with the Site Health and Safety Plan. Employees are responsible for reporting any unsafe acts or conditions, safety incidents, accidents, injuries, or exposures to the Site Safety Officer.

As pursuant to 29 CFR 1910.120[e] (OSHA); all on-site personnel shall have received a minimum of 40 hours of off-site classroom training. This training shall include, but not be limited to those topics addressed in that section. Warzyn's in-house Basic Hazardous Waste Site Health and Safety training meets these requirements. Non-Warzyn personnel will be required to provide documentation as to their training. An on-site start-up health and safety meeting and daily morning safety briefings will also be required. This health and safety plan will form part of this training, and will be provided to all site personnel. All on-site training will be documented in the site log book.

Also required by 29 CFR 1910.120[f] (OSHA); all on-site personnel that have a potential for exposure to hazardous material, or will be required to wear a respirator, must receive a physical examination that will determine their fitness for these tasks. This determination will be received before any field work will begin.

4.0 SITE WORK PLAN

4.1 General

1. All personnel at the site (workers and visitors) will be required to read the Site Health and Safety Plan and sign a statement indicating that they have done so.

2. All visitors to the site must check in with the Site Project Manager or Site Safety Officer. A sign will be posted at the entrance gate indicating this procedure.

3. Special emergency equipment (eyewash, fire extinguisher, first aid kits, etc.), will be maintained on-site. The location of this equipment is presented in Section 10 - Emergency Response and Information Section.

4. All self-contained breathing apparatus (SCBA) or airline respirators used on site will be positive pressure demand.

5. Whenever possible, drill rigs will be located so the rear of the rig is pointing upwind of each respective drill hole.

6. All split-spoons and Shelby tubes will be THOROUGHLY STEAM CLEANED PRIOR TO USE AT THE SITE. Similarly, all paint on new split-spoons will be carefully removed.

   All drilling equipment which comes into contact with soils will be steam cleaned between holes. The drill rig will be steam cleaned as appropriate or necessary to guard against cross-contamination.

4.1.1 Personal Protective Equipment

The following equipment will be used for Level B protection:

- Polycoated Coverall
- Steel-toe/Steel-shank Leather Boots with Neoprene Overshoe OR Neoprene Boots with Steel-toe/Steel Shank
- Latex Booties
- Surgical Gloves
- Neoprene Gloves

- Self-contained Breathing Apparatus (SCBA) or Air-line Respirator with 5-minute escape pack
- Hardhat

The following equipment will be used for Level C protection:

- Polycoated Tyvek Coverall
- Steel-toe/Steel-shank Leather Boots with Neoprene Overshoe OR Neoprene Boots with Steel-toe/Steel Shank
- Latex Booties
- Surgical Gloves
- Neoprene Gloves
- Full-face, Air-purifying Respirator w/combination cartridge
- Hardhat

The following equipment will be used for modified Level D protection:

- Polycoated Tyvek Coverall
- Steel-toe/Steel-shank Leather Boots with Neoprene Overshoe OR Neoprene Boots with Steel-toe/Steel-shank
- Latex Booties
- Surgical Gloves
- Neoprene Gloves
- Safety Glasses
- Hardhat
- Face Shields (where splash hazards exist)

The following equipment will be used for modified Level E Protection:

- Steel-toe/steel-shank leather boots OR Neoprene Boots with steel toe/steel shank
- Hardhat
- Long Sleeve Shirt
- Heavy Pants

All personal protective equipment will be selected based upon knowledge of expected contaminants, using available manufacturer's and/or general industry test data relating both the method and materials of construction to an ability to protect personnel from expected contaminants. The Site Safety Officer and other Warzyn Health and Safety professionals may, upon evaluation of such clothing in the field, implement prudent changes in the specific type of equipment utilized if there are indications of insufficient protection against specific contaminants or waste materials being encountered due to changing site conditions.

Respirator cartridges will be NIOSH approved high efficiency, organic vapor/acid gas/dust (such as MSA brand GMC-H). The use, maintenance and storage of all respiratory protection equipment by personnel at this site will follow the procedures outlined in the Site Respiratory Protection Plan found in Appendix D.

Drill crew personnel will tape the wrists and ankles of their protective clothing with duct tape to ensure a complete seal.

4.1.2 Surveillance Activities and Action Levels

The air monitoring program will begin with an air monitoring survey of the site to assess the ambient conditions. The frequency of air monitoring, for tasks which do not disturb the ground, will be determined in part based on this survey. Other factors such as temperature and windspeed will also be considered.

Air monitoring will be conducted during tasks which disturb the in-situ conditions of the site environment. A minimum frequency of once every two hours will be the protocol for this monitoring. Examples of such tasks would be sediment sampling and groundwater sampling.

Nearly constant air monitoring will be conducted while drilling into refuse and excavation of test pits.

An HNu Photoionizer (with 11.7 ev lamp) will be used by the Site Safety Officer for monitoring of air quality at the work sites. This will be done to assess the relative levels of organic airborne contaminants, aiding in site assessment.

A Gastech Model 1939-OX Percent Gas and Oxygen Indicator will be used to detect the presence of explosive gases and determine available oxygen levels.

A Monitox hydrogen cyanide detector will be used to detect hydrogen cyanide during waste characterization operations.

A Rad-Mini will be used to detect the presence of radioactive materials.

Selected "Draeger-type" tubes will be available for utilization in testing for the presence of particular volatile toxic compounds such as hydrogen cyanide or vinyl chloride.

The following action levels will be observed during any on-site activity:

EXPLOSIMETER (Ambient Air Measurements)

0-10% LEL - proceed w/caution

10-25% LEL - proceed w/caution, be prepared to shut-down quickly

over 25% LEL - shut-down immediately and evacuate. Do not resume excavation until LEL falls below 10%. If LEL remains above 25%, continued excavation will be at discretion of Site Safety Officer.

≈ 25% call RPM and discuss alternative

HNu (Breathing Zone)

- Enter Site at Level C
- 5 ppm or greater detected, upgrade to Level B
- If any above-background readings up to 5 ppm detected, remain at Level C. Monitor ambient air as often as possible to detect any change in detection levels.

Set alarm @ 5ppm

MONITOX: A level of 10 ppm hydrogen cyanide will require immediate evacuation of the work area. The Site Safety Officer will verify the monitor reading by sampling the area with a hydrogen cyanide Draeger Tube. If the results are positive, the hydrogen cyanide contingency plan (Attachment C) will be initiated.

RAD-MINI: Less than 1 mR/hr., continue investigation; above background but below 10 mR/hr, continue investigation but perform more extensive and continual monitoring; above 10 mR/hr, evacuate site and consult with client. and RPM.

Several of the modified subtasks outlined in the work plan are specified as being performed in Level D protection. Level D has been selected because those activities appear to have low potential for exposure of field personnel to hazardous materials. However, because of known surface soil contamination at the site, dust conditions may present a potential health threat. The Site Safety Officer may therefore upgrade Level D activities to Level C or B, based on soil moisture conditions and wind factors.

4.1.3 Standard Operating Procedures

(a) Personal Precautions

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated contaminated.

- Hands and face must be thoroughly washed upon leaving the work area.

- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

- No facial hair which interferes with a satisfactory fit of the mask-to-face-seal is allowed on personnel required to wear respirators.

- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, discolored surfaces, kneel on ground, lean, sit, or place equipment on drums, containers, or the ground.

- Medicine and alcohol can potentiate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel at hazardous waste operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Alcoholic beverage intake should be minimized or avoided.

- All personnel must be familiar with standard operating safety procedures and any additional instructions and information contained in the Site Safety Plan.

- All personnel must adhere to the information contained in the Site Safety Plan.

- Contact lenses cannot be worn when the hazard of a splash exists.

- Personnel will be aware of symptoms of exposure to toxic chemicals on site and for heat or cold stress.

- Respirators shall be cleaned and disinfected after each day's use or more often, if necessary.

- Prior to donning, respirators will be inspected for worn or deteriorated parts. Emergency respirators and self-contained breathing devices will be inspected at least once a month and after each use.

- The employee will be familiar with all sections of the established respiratory protection program.

(b) Operations

- All personnel going on-site must be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.

- Any required respiratory protective devices and clothing must be worn by all personnel going into areas designated for wearing protective equipment.

- Personnel on-site must use the buddy system when wearing respiratory protective equipment. As a minimum, a third person, suitably equipped as a safety backup, is required during extremely hazardous entries.

- Visual contact must be maintained between pairs on-site and safety personnel. Entry team members should remain close together to assist each other during emergencies.

- During continual operations, on-site workers act as safety backup to each other. Off-site personnel provide emergency assistance.

- Personnel should practice unfamiliar operations prior to doing the actual procedure.

- Entrance and exit locations must be designated and emergency escape routes delineated. Warning signals for site evacuation must be established.

- Communications using radios, hand signals, or other means must be maintained between initial entry members at all times. Emergency communications should be prearranged in case of radio failure, necessity for evacuation of site, or other reasons.

- Wind indicators visible to all personnel will be strategically located throughout the site.

- Personnel and equipment in the contaminated area should be minimized, consistent with effective site operations.

- A site "sign in and out" log will be used to control and monitor site areas. All personnel accessing site must utilize this log.

- Access controls including warning signs and barriers will be utilized at excavations, control zones and areas known to have dangerous contamination levels of known carcinogens.

- If at all possible, personnel will refrain from entry into excavations. If personnel entry into an excavation greater than 5 feet deep is necessary, sloping/shoring and other requirements of OSHA 1926 Subpart P will have to be met.

- Prior to mobilization at the site, personal contact is to be made with emergency room personnel, the Poison Control Center, the local fire department and police. If outside of an established town, contact shall be made with county officials and local emergency services.

- Eye wash fountains, toilet facilities, and first aid equipment will be readily available on-site. Warzyn personnel are to have current first aid and medical emergency training.

- Provisions for the rapid identification of the substance to which the worker has been exposed. This information must be given to medical personnel.

- Procedures for decontamination of injured workers and preventing contamination of medical personnel, equipment, and facilities.

- Sufficient water and/or dry chemical fire extinguishers and neutralizing agents will be maintained on site to aid in initial containment of any fire or release before emergency services can arrive.

(b) Medical Emergencies

Any person who becomes ill or injured in the exclusion zone must be decontaminated as well as possible, with consideration given to which risk will be greater - the spread of contamination or possible negative health affects for the individual. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed (i.e., complete disrobing of the victim and redressing in clean coveralls or wrapping in a blanket). First aid should be administered while awaiting an ambulance or paramedics. Personnel trained and certified in first aid and CPR will be on-site during all active operations.

Anyone being transported to a clinic or hospital for treatment should have available to them information on the chemical(s) they have been potentially exposed to at the site and their own medical history. The medical information will reside at the designated medical provider's office for Warzyn Engineering.

Any vehicle used to transport contaminated personnel, will be tested and cleaned, as necessary, by a person designated by the Site Safety Officer.

4.2 Specific Field Activities

Subtask 1B Site Survey
Surveying personnel will be in modified Level E protection as described in 4.1.1.

Subtask 1C Geophysical Survey
Surveying personnel will be in modified Level E protection as described in 4.1.1

Subtask 1D Surface Water Survey
Surveying personnel will be in modified Level E protection as described in 4.1.1

Activity 2A.1 Monitor ACS Hydraulics
Personnel will begin monitoring activities at Level C and the Safety Officer may upgrade or downgrade the personal protective level as described in 4.1.2

Activity 2.A.2.a. Install Leachate Wells
Level C protection as described in 4.1.1 will be worn during installation of wells into the landfill, with possible upgrade or downgrade of level of protection by the Safety Officer as described in 4.1.1 and 4.1.2.

Activity 2A.2.b. Monitoring De-Watering Pumpage
Activity will begin at Level E with possible up or downgrade of level of personal protection by the Safety Officer as described in 4.1.1 and 4.1.2.

Activity 2A.3 Install Perimeter Monitoring Wells
Activity will be conducted at Level C with possible up or downgrade of level of personal protection by Safety Officer as described in 4.1.1 and 4.1.2.

Activity 2A.3.a. Test Near Surface Hydraulic Properties
Activity will begin at Level C with possible up or downgrade of level of personal protection by the Safety Officer as described in 4.1.1 and 4.1.2.

Activity 2A.4 Install Piezometer Grid
Level D will be worn for those locations outside the landfill. Inside the landfill area, Level C will be worn, with possible up or downgrade of level of protection by the Safety Officer as described in 4.1.1 and 4.1.2.

Activity 2B.1 Effluent Sampling
Level D will be worn with possible upgrade of level of protection by the Safety Officer as described in 4.1.1 and 4.1.2.

Activity 2B.2 Groundwater Sampling for Perimeter Wells and Leachate Wells
Level D will be worn for sampling perimeter wells and leachate wells, with possible upgrade of level of protection by the Safety Officer as described in 4.1.1 and 4.1.2.

Activity 2B.3 Surface Water and Sediment Sampling
Level E will be worn as described in Subtask 2B.2.

Activity 3A.1 Soil Borings, Test Pits and Surface Soil Sampling
Level B will be worn during test pit excavations. The backhoe operator will remain in cab to enable quick closure of pit in event of an emergency. Excavated material will be placed at the downwind end of the pit for inspection. At no time will an open pit be left unattended. All test pits will be filled before beginning a new excavation, and at the end of each working day.

Potential physical hazards include: cave-in, overhead wires, and underground utilities or objects. Local utilities will be contacted to review locations.

Level D will be worn during surface soil sampling and soil borings.

Except where soil borings are expected to permeate suspected or known areas of waste disposal Level C is to be worn.

Activity 4A.1 and 4A.2 Well Installation and Aquifer Testing
Level C will be worn as described in Activity 2A.3 during well installations. Level D will be worn during aquifer testing as described in Subtask 2B.2.

Activity 4A.3 On-site Well Installation and Private Well Sampling
Level C will be used for well installation as discussed under Activity 2A.3. Sampling of private wells will not require any special personal protective equipment.

Subtask 4B. Soil Contamination
Level D will be worn as described in Subtask 2B.1.

5.0 DECONTAMINATION PROCEDURES

Every attempt will be made to prevent direct contact with contaminated materials. The sequential removal and decontamination or disposal of potentially contaminated personal protective equipment is required to prevent the migration of contaminants to the support zone where personal protective equipment is not required.

All personnel, equipment and vehicles coming in contact with contaminated materials or areas will be required to go through decontamination procedures.

Site personnel decontamination procedures:

- Prior to entering the contamination reduction zone, remove gross contamination from protective garments and footwear
- Remove and dispose of outer latex booties
- Wash boots in trisodium phosphate detergent (TSP) bootwash
- Clean outer gloves in TSP wash solution (discard if too soiled to clean thoroughly)
- Remove and dispose of polycoated tyvek suits
- Respirator or SCBA is removed and either prepare for reuse or undergo daily decontamination procedures
- Remove and dispose of surgical gloves
- Wash hands in hand wash

All site personnel will perform the above mentioned decontamination procedure prior to leaving the site. Additionally, all personnel upon reaching their residence must shower.

Discarded clothing and other articles will be collected in double-lined, heavy-duty garbage bags and stored on-site.

Equipment and vehicle decontamination procedure:

- Decontamination will be performed on-site
- Gross contamination will be removed with a brush and TSP solution
- Steam cleaning will follow

All drilling equipment will be steam cleaned prior to exiting off-site. This will be conducted at the "Equipment and Vehicle Area". Another area located away from this area will be designated as the "Site Personnel Decontamination Area" and will be used as outlined.

Decontamination wash waters and cutting from the drilling activities will be left on-site and stored in DOT 55-gallon hazardous waste drums or equivalent or staged on visqueen and tarped.

Equipment remaining at the site may not be decontaminated, but will be stored on the contaminated side of the equipment and vehicle decontamination area at the end of each day.

Special care will be taken that **ALL SPLIT-SPOONS AND SHELBY TUBES ARE THOROUGHLY STEAM CLEANED PRIOR TO USE AT THE SITE.** Similarly, any paint on split-spoons will be thoroughly removed.

6.0 DISPOSAL OF INVESTIGATION-DERIVED WASTE MATERIALS

Used wash water generated at the Personnel Decontamination Area will be considered non-hazardous, not warranting special waste disposal. This water will be disposed at the site where it was generated. Contaminants brushed off and steam-cleaner-removed from equipment and vehicles will be stored in DOT, 55-gallon drums or equivalent.

Bags containing contaminated personal protective equipment and related articles will be stored on-site and disposed accordingly at the completion of RI/FS and stored in DOT, 55-gallon drums or equivalent.

Soil, waste cuttings, and purge water from soil boring, well installations, and sampling will remain on-site and stored in DOT, 55-gallon drums or equivalent. These materials will be disposed at the completion of the RI/FS activities pending the findings of the RI/FS sampling analysis and/or remediation alternative.

How will it be stored?

7.0 THERMAL STRESS CONDITIONS

Special care will be taken to insure that work crew personnel do not suffer physical distress as a result of working under hot or cold weather conditions. This is discussed in Appendix B. Guidelines presented in this discussion will be generally followed. Individual physical differences and varying susceptibilities to heat stress will be considered in scheduling work activities.

8.0 WORK LIMITATIONS

In general, all field activities will be restricted to daylight hours. No drilling or other heavy machinery will be operated after daylight hours. Lightning conditions will necessitate shut-down of drilling operations. In the event of rain, the Drill Crew Supervisor and Site Safety Officer will determine the need for suspending drilling operations. The Site Safety Officer and Site Project Manager will be responsible for determining continuance/shut-down of field activities during adverse weather conditions.

9.0 PERSONNEL RESPONSIBILITIES AND TRAINING

Training for on-site personnel shall conform with OSHA 29 CFR 1926, subpart "c", General Safety and Health Provisions. There will be an initial Site Safety Meeting, during which all site workers will be supplied with a copy of the Health and Safety Plan. The Site Safety Officer will discuss the site, and workers will be instructed in the recognition, avoidance and prevention of unsafe activities and conditions. Emergency practices and procedures will be reviewed.

The following table lists specific personnel, and job positions.

Team Member	Responsibility
_____	Project Manager
_____	On-Site Project Manager
_____	Team Leader/Hydrogeologist
_____	Site Safety Officer
_____	Drill Crew Supervisor
_____	Drill Crew Supervisor
_____	Driller's Assistant
_____	Driller's Assistant
_____	Field Technician
_____	Field Technician

Note: Names will be filled in later as specific assignments are made.

Required Training

RI/FS Hazardous Waste Site Investigation Training
Medical Monitoring Program
Respiratory Protection Training

The Hazardous Waste Site Investigation Training shall consist of Warzyn's in-house training program or equivalent. Respiratory Protection Training is included in this program, and additional training will be given on-site by the Site Safety Officer.

10.0 EMERGENCY RESPONSE AND INFORMATION

10.1 Prearrangements

Local police, fire, emergency squads and hospitals will be contacted prior to the initiation of site activities. They will be informed of the location of the site, activities which are to be conducted, time schedules, and potential hazards associated with the work and the area. If possible, a field radio will be obtained from these agencies, providing immediate contact with them. The Site Safety Officer will retain any such radios.

10.2 On-Site Communication System

On-site communication procedures will be established in the field during the initial site briefing or whenever there is a change of site personnel. An emergency signal, two blasts from an airborne, will be used to indicate site evacuation in the event of an emergency. Such horns will be placed in the office trailer and at the outer perimeter of the contamination reduction zone. Employees will be trained in recognition of this and alternative back-up hand signals, as well as in the appropriate routes of egress and points of re-assembly.

10.3 Work Site Emergency Procedures

In the event of a medical emergency at a work site, work crew personnel will act quickly and reasonably to remedy the situation. If the Site Safety Officer is present, the SSO will give directions as to how to proceed. If not, the SSO will be contacted by phone. If unavailable, the local Emergency Squad will be contacted.

Special care will be taken if rescue efforts are necessary. All personnel shall utilize extreme caution and take all possible steps to be as adequately protected as possible before attempting such rescue.

In the event of a hazardous gaseous release, work crew personnel will depart the work site, moving 100 feet upwind and regrouping. The Site Safety Officer will then be conferred with.

10.4 Emergency Equipment

The following emergency equipment will be maintained maintained at the command post.

- Fire Extinguisher
- Eye Wash
- First-Aid Kit
- 5 Gallons of Fresh Water (for flushing of skin)

10.5 Emergency Contact Numbers

Munster Community Hospital.....(219) 836-1600
Griffith Police (Emergency).....(219) 924-3141
Griffith Police (Non-Emergency).....(219) 924-7503
Griffith Fire Department.....(219) 924-3151
Fagin-Miller Ambulance.....(219) 924-6543
National Poison Center.....(800) 942-5969
National Response Center.....(800) 424-8802
U.S. Environmental Protection Agency
    Emergency Environmental Response.....(312) 353-2318
    Hazardous Waste Hotline.....(800) 621-3191
Lean Matejka, Health and Safety Coordinator, Warzyn Engineering Inc.
    Office.....(312) 773-8484
    Home.....(312) 418-0678

Hospital route maps will be posted at the command post and will be maintained in each site vehicle. A copy of the hospital route map is shown in Figure 4.

[WP1]
251HSP01LAM/gmg/

TABLES

Table 1
Disposal Locations and Waste Types

LOCATION	CLASSIFICATION	WASTE TYPES
American Chemical Services, Inc. Property		
Off-site Containment Area (Figure 3/Location C)	Documented Waste Disposal Location	Drums of PCB-contaminated waste. 10,000 cubic yards of distillation bottoms (drummed). Drums containing solidified materials. 68 cubic yards of incinerator ash Chlorinated solvents Acetone MEK still bottoms Cresylic acid, cyanide and chromium from plating operation Lead pigments Several hundred cases of empty bottles that had contained 2,4,D and 2,4,5-TP Tank truck containing 500 gallons of solidified paint 200 drums containing solvent solids of benzene, amylacetate, dimethyl aniline, diethylether.
On-site Containment Area (Figure 3/Location E)	Documented Waste Disposal	400 drums of sludge and semi-solids of unknown type.
Old Still Bottom Pond (Figure 3/Location F)	Documented Waste Disposal Location	253,510 gallons and 2,000 drums of still bottom sludge, containing 1,1,1-trichlorethane, trichloroethylene, methylene, chloride, toluene, benzene, and other low boiling point solvents.

Table 1
Disposal Locations and Waste Types
(Continued)

LOCATION	CLASSIFICATION	WASTE TYPES
Treatment Pond Number 1 (Figure 3/Location G)	Documented Waste Disposal Location	200 drums containing solvent, solids of benzene, amylacetate
Kapica Drum, Inc. Drum Draining Area (Figure 3/Location L)	Suspected Soil Contamination Location	Drum residue and drum rinse water from drum recycling operation.
Old Drum Storage Area (Figure 3/Location M)	Suspected Soil Contamination Location	Suspected soil contamination from unknown waste type
Old Wastewater Trenches (Figure 3/Locations I, J, K)	Suspected Soil Contamination	Suspected soil contamination from wastes containing 1,1,1-trichloroethane, trichloroethylele, methylene chloride, toluene, benzene and other low boiling point solvents.
Kapica Drum, Inc. Property		
(Figure 3/Location O)	Suspected Soil Contamination	Suspected soil contamination from residue and drum rinse water from drum recycling operation.
Griffith Landfill Property		
(Figure 3/Location D)	Suspected Waste Disposal Location	10 gallons per week for 12 years of retained samples containing hazardous substances 2,500 drums of residues from drum recycling operation

TABLE 2
GROUNDWATER CHARACTERISTICS

Compound	Highest Detected
Benzene	29.0 mg/l[1]
Toluene	35.0 mg/l[1]
Vinyl Chloride	3.6 mg/l[2]
Chloroethane	980 mg/l[1]
Ethyl Benzene	10.0 mg/l[1]
1,2-Trans-Dichloroethylene	34.0 mg/l[1]
Methylene Chloride	2.2 mg/l[2]
1,1-Dichloroethane	1.3 mg/l[2]
1,2-Dichloroethane	0.67 mg/l[2]
Trichloroethylene	0.039 mg/l[2]
Phenol	0.750 mg/l[2]
2,4-Dimethyl Phenol	33.0 mg/l[1]
Pentachlorophenol	36.0 mg/l[1]
Bis (2-Chloroethyl) ether	327.0 mg/l[1]
1,1,1-Trichloroethane	1.1 mg/l[1]

Notes:

1 Ecology and Environment Well Sampling Results, November 3, 1982.

2 Phase I Report, Preliminary Hydrogeological Assessment, American Chemical Services, Colfax Avenue, Griffith, Indiana, ATEC Associates, 1/15/86.

3 mg/l - milligrams per liter

TABLE 3
SEDIMENT/SOIL (ON-SITE)
ORGANICS
HIGHEST DETECTED

Compound	Highest Detected[1]
Phenol	26 ppb
Isophorone	6.2 ppb
Naphthalene	12,000 ppb
Fluorene	1,000 ppb
Diethylphthalate	2,500 ppb
Phenanthrene and Anthracene	1,400 ppb
Di-n-Butyl phthalate	1,100 ppb
Bis (2-Ethylhexyl) Phthalate	110,000 ppb
Butlybenzyl phthalate	8,300 ppb
Methyl naphthalenes	32,000 ppb
Dimethyl naphthalenes	22,000 ppb
Diphenyl ether	3,800 ppb

Metals/Cyanide	Highest Detected[1]
Cadmium	<0.2 ug/g
Chromium	11 ug/g
Nickel	9 ug/g
Lead	15 ug/g
Mercury	.049 ug/g
Cyanide	<0.3 ug/g

Notes:

1 Organic Analytical Results from samples collected at American Chemical Services and Griffith Landfill, Griffith Park, Indiana, May 9, 1980. U.S. EPA, CRL, Organic Laboratory Section 6/13/80.

2 Tentatively Identified Compounds (TIC)

3 ppb = parts per billion
ug/g = micrograms per gram
mg/l = milligrams per liter

TABLE 4
LEACHATE/SURFACE WATER

Compound	Highest Detected
Napthalene	29 ppb[2]
Phenol	350 ppb[2]
Diethylphthalate	10 ppb[2]
Phenanthrene and Anthracene	0.1 ppb[2]
Bis (2-Ethylhexyl) Phthalate	510 ppb[2]
Bis (2-Chloroethyl) ether	300 ppb[2]
Dimethylphthalate	2,300 ppb[2]
(2-Ethoxy) Ethyl Acetate	17,000 ppb[2, 3]
2-(Hydroxymethyl)-1-Pentanol	40,000 ppb[2, 3]
Trimethyl-2-Cyclohexen-1-one	36,000 ppb[2, 3]
N-Methyl-2-Pyrrolidone	11,000 ppb[2, 3]
1- (2-Butoxyethoxy) Ethanol	6,800 ppb[2, 3]
2-Ethylhexanoic Acid	4,100 ppb[2, 3]
Methylphenols (2)	57,000 ppb[2, 3]
Ethylphenols (3)	58,000 ppb[2, 3]
Dimethylphenols (3)	15,000 ppb[2, 3]
Pentylphenol	4,100 ppb[2, 3]
Methoxytrimethylphenol	11,000 ppb[2, 3]
Dimethyl Benzenedicarboxylate	5,300 ppb[2, 3]
2,2,4-Trimethyl-3-Cyclohexene -1-Methanol	1,700 ppb[2, 3]
2-(2-Methoxy-1-Methylethoxy) -1-Propanol	500 ppb[2, 3]
2-(2-Methoxy-1-Methylethoxy) -2-Propanol	43 ppb[2, 3]
1,1-Oxybis-2-Chloroethane	53 ppb[2, 3]
3,3-5-Trimethylcyclohexene	460 ppb[2, 3]
Benzene	1665 mg/l[1]
Ethyl benzene	0.030 mg/l[1]
Toluene	1.34 mg/l[1]
TOX	5.74 mg/l[1]

TABLE 4
LEACHATE/SURFACE WATER
(Continued)

Metals/Cyanide	Highest Detected
Cadmium	184 ug/l[1]
Chromium	254 ug/l[1]
Nickel	544 ug/l[1]
Lead	282 ug/l[1]
Mercury	0.8 ug/l[1]
Cyanide	96 ug/l[1]

Notes:

1 Letter: ATEC Associates to L. Rundio, May 2, 1986 transmitting results from March 1986 sampling.

2 Organic Analytical Results for samples collected at American Chemical Services and Griffith Landfill, Griffith Park, Indiana, May 9, 1980, U.S. EPA, CRL, Organic Laboratory section, 6/13/80.

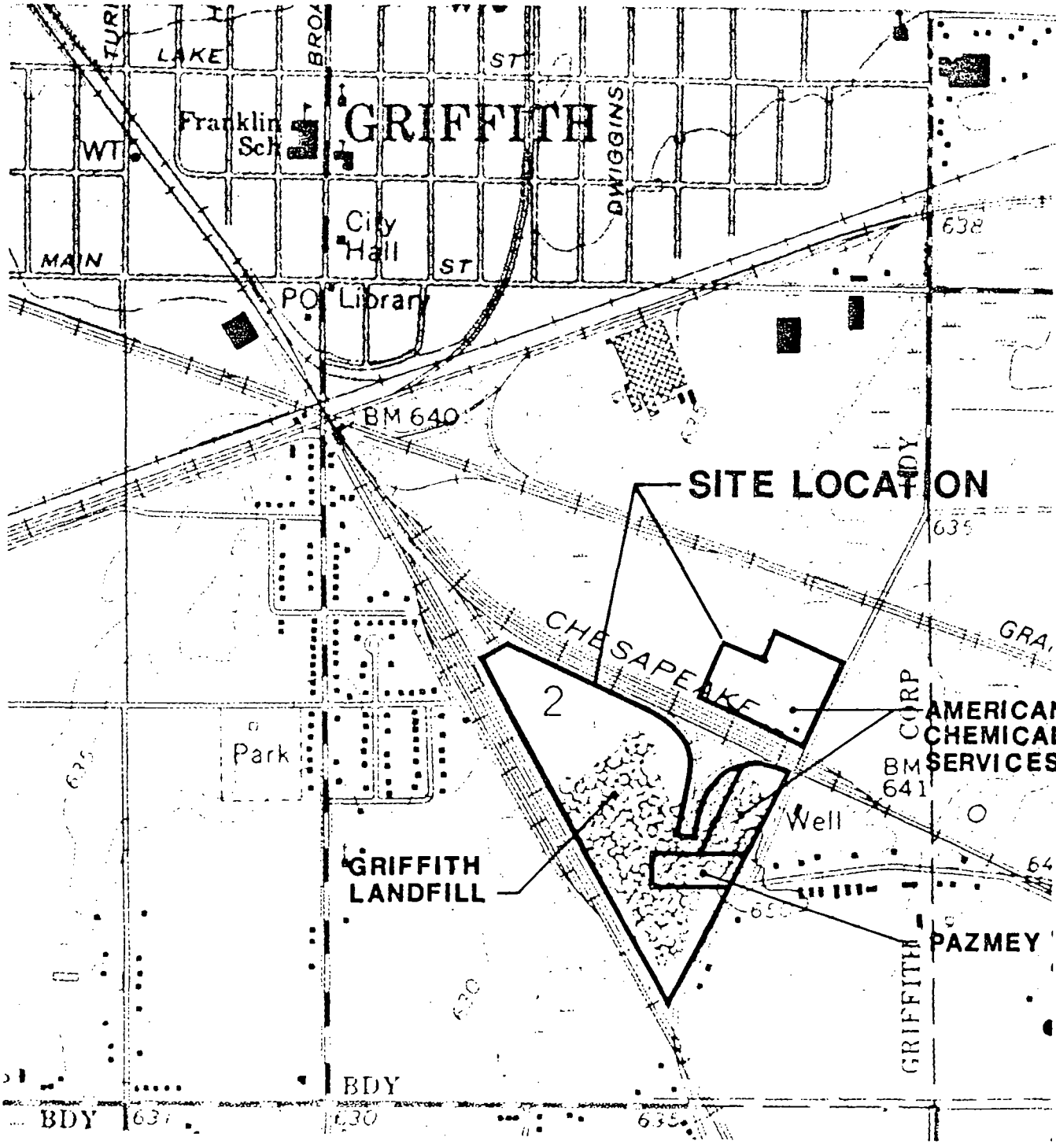
3 Tentatively Identified Compounds (TIC)

4 ppb = parts per billion
ug/l = micrograms per liter
mg/l = milligrams per liter

Table 5
Chemical Hazard Information

Compound	Odor Characteristic	Odor Threshold (ppm)	Ionization Potential (ev)	Vapor Pressure (ppm)	TLV (ppm)	Dermal Toxicity	PEL ppm
Benzene	aromatic hydrocarbon	4.68	9.25	75	10	extreme	1 (0.5 **)
Dichloethylether (bis 2-chloroethyl ether)	chlorinated solvent-like	--	--	0.4	5	extreme	*(c) 15
Ethyl chloride (chloroethane)	ether-like	3.7 - 4.4	10.97	1064	1000	moderate local	1000
Ethylbenzene	aromatic	14 hydrocarbon	8.76	7.1	100	high	100
Phenol	sweet tarry odor	0.05	8.5	0.36	5	moderate	*5
Phthalates	--	--	--	0.01	5	--	---
Trichloroethane	chloroform-like	100	--	100	350	high	*350
1,2-Trans-Dichloroethylene	ether-like	275	9.65	180-265	200	--	200
Toluene	benzyl-like	.17 - .40	8.82	22	100	slight	200
Vinyl Chloride	faintly sweet	260	9.99	2580	5	extreme	1 (0.5 **)

NOTE: Information specific to other compoudns present may be found in Section 3.0.
(c) = Ceiling
* = Skin absorbed exposure level
** = Action level under expanded OSHA standards, including training and medical monitoring.



NOTE:

1. SITE LOCATION MAP WAS DEVELOPED FROM U.S.G.S. 7½ MINUTE QUADRANGLE MAP ENTITLED HIGHLAND, INDIANA 1968, PHOTOREVISED 1980.

north

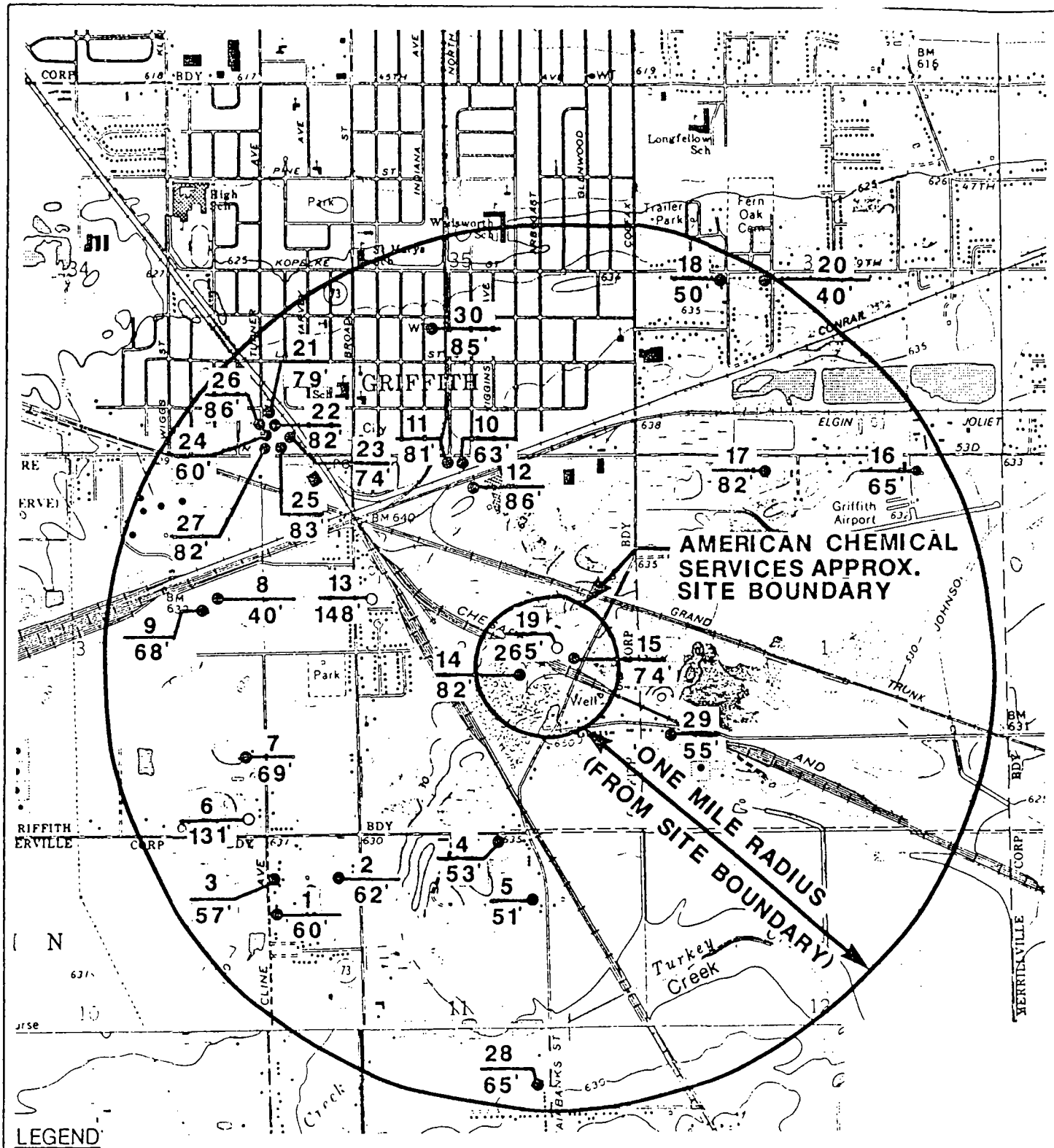
SCALE: 1"= 1000'

FIGURE 1

DWN SJP	APP'D PSV	DATE 9/23/88	60251-A2

WARZYN

SITE LOCATION MAP
RI/FS
AMERICAN CHEMICAL SERVICES SITE
GRIFFITH, INDIANA



LEGEND

1 - WELL REFERENCE NUMBER
60 - DEPTH OF WELL (FEET)

● WELL SCREENED IN UNCONSOLIDATED AQUIFER

○ WELL SCREENED IN ROCK AQUIFER

north

SCALE: 1" = 2000'

NOTE

1. BASE MAP DEVELOPED FROM THE HIGHLAND, INDIANA AND THE ST. JOHN, INDIANA 7 1/2 MINUTE USGS QUADRANGLE MAPS. DATED 1968 AND 1962 RESPECTIVELY PHOTOREVISED 1980.
2. WELL REFERENCE NUMBERS REFER TO ATEC REPORT, JANUARY 1985.

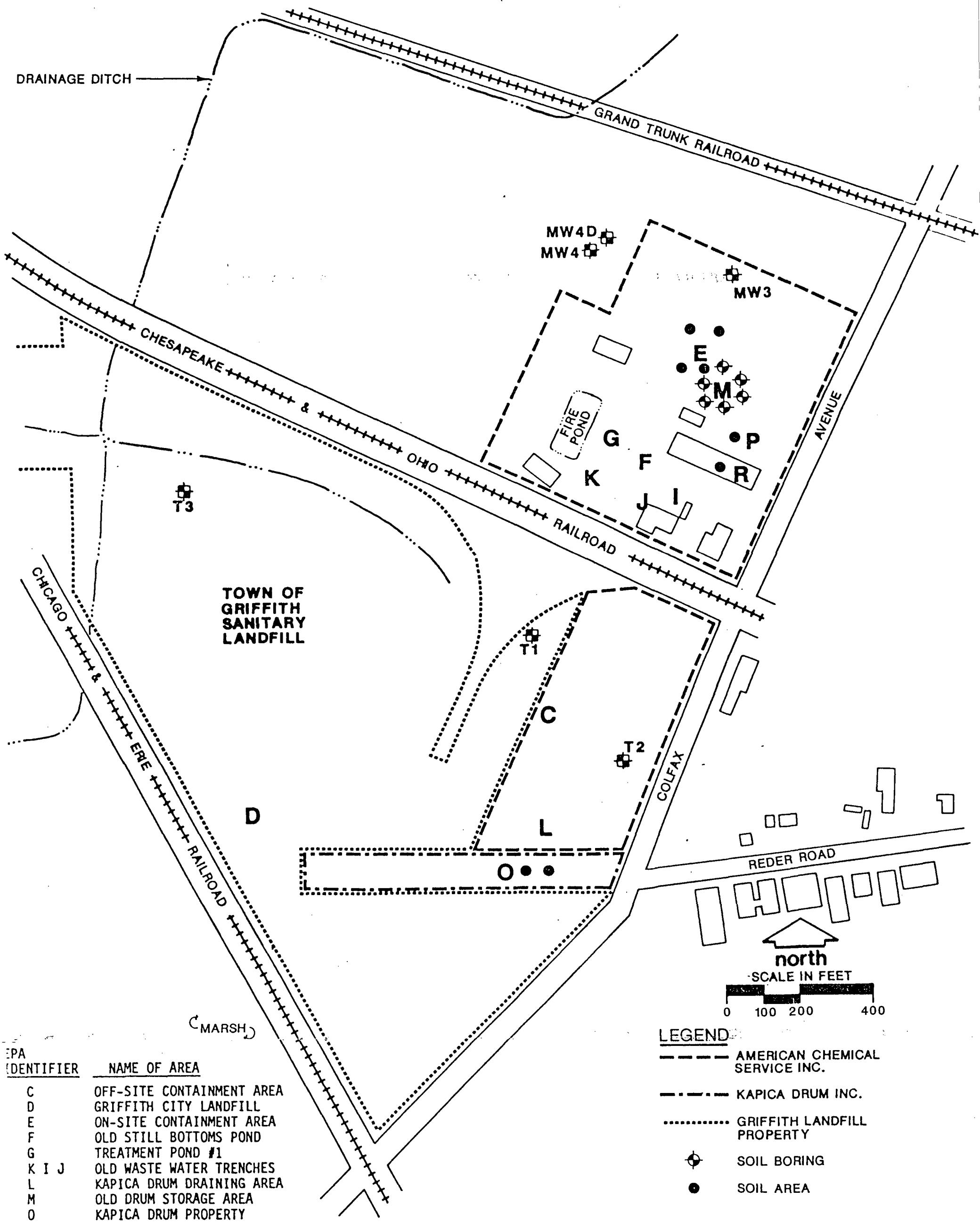
FIGURE 2

DWN JC	APP'D RJV	DATE 9/23/88	60251-A3

WARZYN

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WATER WELL LOCATIONS
AMERICAN CHEMICAL SERVICES SITE
GRIFFITH, INDIANA

TELEDYNE POST N67178



EPA IDENTIFIER	NAME OF AREA
C	OFF-SITE CONTAINMENT AREA
D	GRIFFITH CITY LANDFILL
E	ON-SITE CONTAINMENT AREA
F	OLD STILL BOTTOMS POND
G	TREATMENT POND #1
K I J	OLD WASTE WATER TRENCHES
L	KAPICA DRUM DRAINING AREA
M	OLD DRUM STORAGE AREA
O	KAPICA DRUM PROPERTY
P	FUME INCINERATOR
R	PREVIOUS SPILL/FIRE

LEGEND

- AMERICAN CHEMICAL SERVICE INC.
- KAPICA DRUM INC.
- GRIFFITH LANDFILL PROPERTY
- SOIL BORING
- SOIL AREA

FIGURE 3

WARZYN — Project Number 60251-B6

SOIL BORING & SOIL AREA LOCATIONS
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
AMERICAN CHEMICAL SERVICES SITE
GRIFFITH, INDIANA

WARZYN ENGINEERING INC
Madison • Milwaukee
Minneapolis • Chicago
Detroit

Designed By | Drawn By S.R. | Checked By MJH
Approved By DJV | Date 9/23/88
Scale AS SHOWN | Reference

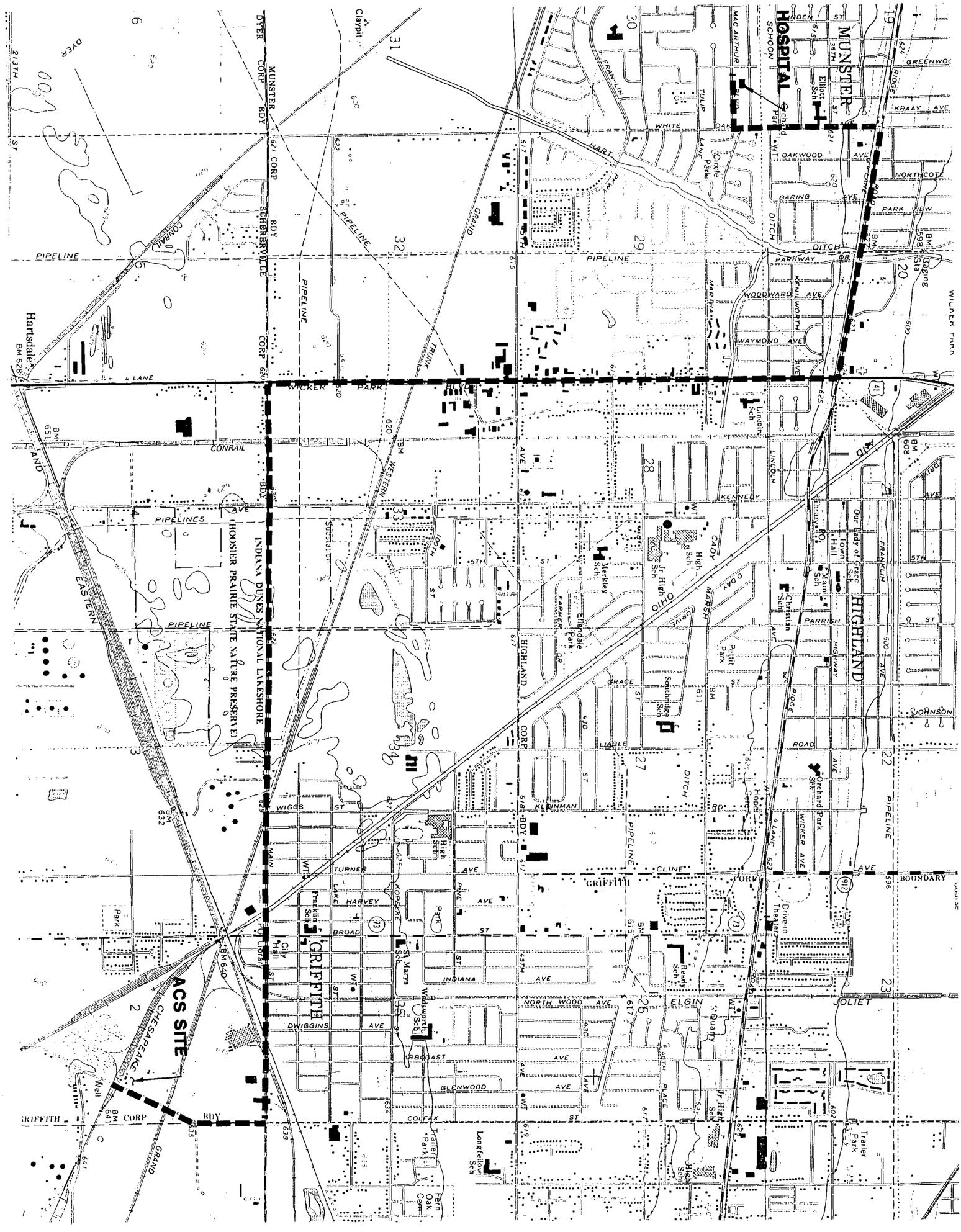


FIGURE 4

WARZYN	Project Number 60251	Sheet Number OF	ROUTE TO HOSPITAL REMEDIAL INVESTIGATION/ FEASIBILITY STUDY AMERICAN CHEMICAL SERVICES SITE GRIFFITH, INDIANA	Revisions / Date / By / App'd	WARZYN ENGINEERING INC. Madison • Milwaukee Minneapolis • Chicago Detroit

Designed By: | Drawn By: D.L.L. | Checked By:
Approved By: PJV | Date: 9/23/88
Scale: | Reference

APPENDIX A

GLOSSARY

APPENDIX A - GLOSSARY

ACGIH -- The American Conference of Governmental Industrial Hygienists

IDLH -- "Immediately Dangerous to Life or Health." This entration represents a maximum level from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects.

PEL -- The Permissible Exposure Limit. This is the same as the TLV.

STEL -- Short Term Exposure Limit. This is the maximum concentration to which workers can be exposed for a period up to 15 minutes continuously without suffering from 1) irritation, 2) chronic or irreversible tissue change, or 3) narcosis of sufficient degree to increase accident proneness, impair self-rescue, or materially reduce work efficiency, provided that no more than four excursions per day are permitted, with at least 60 minutes between exposure periods, and provided that the daily TLV is also not exceeded.

TLV -- Threshold Limit Value. This refers to the time weighted average concentration for a normal 8-hour workday or 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

Ceiling TLV - That concentration which should not be exceeded even instantaneously.

UEL -- The Upper Explosive Limit of substance in air, as expressed in percent by volume. This indicates the percent of a substance, when present in air, which presents a potential risk of explosion.

LEL -- The Lower Explosive Limit of a substance in air, as expressed in percent by volume. This indicates the percent of a substance, when present in air, which presents a potential risk of explosion.

APPENDIX B

THERMAL STRESS CONDITIONS

WARZYN

APPENDIX B - THERMAL STRESS CONDITIONS

Hot Weather Conditions

Working under hot weather conditions requires special health and safety considerations. Heat is generated in the body as a result of normal oxidation processes. Heat, which is produced within the body, is brought to the surface by the bloodstream, and escapes to the cooler surroundings through conduction and radiation. If the surrounding air temperature is equal to or above the body temperature, however, body heat can only be lost through the evaporation of moisture from the skin. The effectiveness of this cooling process decreases as the air humidity increases. Therefore, the cooling system of the human body is greatly reduced on hot, humid, still days. It is on such days (or more commonly, a succession of such days) that the threat of heat-related medical emergencies becomes greatest.

When working during hot weather conditions, specific steps should be taken to lessen the occurrence of heat-related emergencies. These include:

- Drinking plenty of fluids (particularly "Gatorade" or related drinks)
- Taking frequent breaks and cooling off
- Working during cooler parts of day (if possible) such as 5 a.m. to 11 a.m., and 6 p.m. to nightfall

Wearing protective clothing significantly impairs the natural cooling system of the body. Therefore, when such clothing is worn, especially Levels A or B, special care must be taken to allow the body to cool at regular intervals. The following table shows suggested guidelines for wearing protective clothing during hot weather.

Ambient Temp. (degrees F)	Max. Wearing Time (min) per Excursion
above 90	15
85 - 90	30
80 - 85	60
70 - 80	90
60 - 70	120
50 - 60	180

A minimum break period of 10 minutes will be taken. To assess the effectiveness of this "rest-recovery" regime, the heart rate should be monitored using the following system.

1. Count the pulse rate for the last 30 seconds of first minute of three minute period, the last 30 seconds of the second minute, and the last 30 seconds of the third minute.

2. Double the count.

If the recovery pulse rate during the last 30 seconds of the first minute is at 110 beats/minute or less, and the deceleration between the first, second and third minutes is at least 10 beats/minute, then the work-recovery regime is acceptable. If this is not true, a longer rest period is required, and the intake of fluids should be increased.

Heat-related emergencies fall within three categories: heat cramps, heat exhaustion and heat stroke.

HEAT CRAMPS

Symptoms: Painful muscle cramps in legs and abdomen; faintness; profuse perspiration.

Cause: Usually affect people who work in hot environments and are heavy perspirers. May result from too great or too quick consumption of cold drinks. Caused by loss of salt from body.

Care: Remove patient to cool place. Provide with sips of Gatorade (or equivalent). Apply manual pressure to cramped muscle.

HEAT EXHAUSTION

Symptoms: Weak pulse and generalized weakness rapid and shallow breathing; pale, clammy skin; profuse perspiration; dizziness/unconsciousness.

Cause: To aid in cooling of body, large amount of blood is sent to surface area. In upright position, much blood also in lower extremities. This may lead to inadequate return of blood to heart, causing physical collapse.

Care: Remove patient to cool place and remove clothing as possible. Provide with cool water, "Gatorade" or equivalent. Fan to cool but do not chill. Treat for shock.

HEAT STROKE

Heat stroke is the most severe heat-related medical emergency and represents a profound collapse of the body's heat-regulating mechanism. It is a serious threat to life, with a twenty-percent mortality rate. Alcoholics are extremely susceptible to this condition.

Symptoms: Dry, hot, flushed skin; dilated pupils; fast pulse; early loss of consciousness; breathing pattern - initially deep, later shallow or almost absent; muscle twitch (eventually convulsions); body temperature of 105 degrees F or greater.

Cause: Direct exposure to sun, poor air circulation, poor physical condition, advanced age (over 40).

Care: Patients suffering from heat stroke should be regarded as EXTREME MEDICAL EMERGENCY and transported to a medical facility as soon as possible. Assure open airway. Douse body with water or wrap in wet sheet or cloths. Apply cold packs under arms, around neck, at ankles. Assist during convulsions to protect from injury.

Cold Weather Conditions

Hypothermia is an acute problem resulting from prolonged cold exposure and heat loss. This is almost always the result of improper dress. Exasperating the problem is the fact that as an individual becomes fatigued during physical activity, he will be more prone to heat loss, and, as exhaustion approaches, sudden dilation of the blood vessels occurs, with the resultant rapid loss of heat.

In general, proper dress can be worn in the field to protect from the occurrence of hypothermia. The use of protective tyvek coveralls also aids in this, in that they are effective in shielding the body from winds, and maintain an insulating air layer between the coverall and the clothing.

Frostbite is the greatest threat to the field worker during cold weather. Frostbite occurs when there is actual freezing of the tissues. The theoretical freezing point of the skin is about 30 degrees F; however, the increasing wind velocity, heat loss is considerably greater, and frostbite will occur more rapidly. Because the face is generally exposed during field work, it is highly susceptible to frostbite. Care should be taken to ensure that the facial skin does not approach freezing temperatures. At the first signs of numbness or stinging, the worker will return to a warm environment and allow the face to warm-up. When possible, wind-blinds may be constructed to shield workers from prevailing winds.

The hands and feet must also be carefully protected from frostbite. Proper footwear, both insulated and waterproof, should be worn at all times. Inner glove liners, made of cotton or similar material, will aid in keeping the hands warm. Care should be taken to keep the hands and feet from becoming overly cold. At the first signs of numbness or stinging, the worker will find appropriate warm shelter and allow the feet and hands to warm thoroughly before returning to work.

APPENDIX C

HYDROGEN CYANIDE CONTINGENCY PLAN

WARZYN

APPENDIX C - HYDROGEN CYANIDE CONTINGENCY PLAN

Should hydrogen cyanide levels in excess of 10 ppm be encountered, workers will withdraw upwind. If not on-site, the Site Safety Officer will be contacted. The excavation/drill hole will be allowed to vent and then be rechecked by the Site Safety Officer. If levels are below 10 ppm, work will be continued, with close HCN monitoring.

If levels do not fall below 10 mmp within 20 to 30 minutes, the area will be covered as best as possible with available materials. Workers will remain upwind at all times during this closure operation. The Site Safety Officer will be in charge of this operation. Re-entry of a "closed" area will not be performed without close consultation with the client.

APPENDIX D

RESPIRATORY PROTECTION PROGRAM

WARZYN

RESPIRATORY PROTECTION PROGRAM

I. Introduction

As prescribed in the Occupational Safety and Health Administration's (OSHA) Safety and HEalth Standards, 29 CFR Part 1910.134, Warzyn Engineering, Inc. (Warzyn) presents its Respiratory Protection Program (RPP). This program has been developed based upon 29 CFR Part 1910.134, 30 CFR part II and the American National Standards Institute (ANSI) Standard Z88.2: "Practices for Respiratory Protection" (10980 Revision).

As required in these regulations, Warzyn is responsible for the establishment and maintenance of a respiratory protection program. Warzyn shall therefore, provide respirators to their personnel when such equipment is necessary to protect the employee's health. The respirators provided by Warzyn shall be approved by NIOSH/MSHA and applicable/suitable for their intended use.

Employees of Warzyn must agree to use the provided respiratory protection equipment in accordance with instructions and training which are furnished. Each Warzyn employee has prime responsibility for the daily care and maintenance of respiratory equipment issued to him/her by Warzyn.

II. Purpose

The purpose of this document is to establish written standard operating procedures (SOP) to be followed by Warzyn employees in order to optimize respiratory protection during work on hazardous waste sites and other locations when warranted. These standard operating procedures contain all information needed to maintain an effective respiratory protection program to meet the user's requirements in situations where dangerous atmospheres such as harmful dust, fumes, sprays, mists, fogs, smokes, vapors, or gases are present and engineering controls can not adequately protect Warzyn personnel involved in project work at such locations.

III. Scope

The Warzyn Respiratory Protection Program will provide four types of Respiratory protection to the employee, depending on the type and concentration of exposure. The respiratory protection is broken up into the following categories:

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1. Air Purifying Respirators (APR)

   - Shall be used in areas designated appropriate protection, as per site specific Health and Safety Plan.

2. Powered Air Purifying Respirators (PAPR)

   - Shall be used for all appropriate Asbestos-related work.

3. Self-contained Breathing Apparatus (SCBA)

   - Shall be used at hazardous waste sites in which the exposure of air borne organic vapors requires this level of protection.

Warzyn will only allow employees to utilize full face respirators and selection and issuance of such protective equipment will be uniform to all field employees. Selection of brands and models of respiratory equipment utilized will be based upon initial and periodic reviews of such equipment by the Warzyn Health and Safety management. These reviews will combine available test data, available literature and field evaluation of the performance and effectiveness of such equipment. Respirator cartridges will be selected on the basis of the hazard known or expected to be present.

Users will be instructed in the proper use and the limitations of the respirators. The training will be based on manufacturer's direction and includes, but not limited to:

1. Preparing for fitting
2. Fit testing
3. Inspection procedures
4. Proper use and wearing instructions
5. Maintenance and sanitation instructions
6. The nature of the airborne exposure hazard encountered.

When possible, respirators will be assigned to individual workers for their exclusive use. Workers will be responsible for maintenance and sanitation of respirators assigned to them. Periodic and frequent spot checks will be made by supervisory personnel to insure compliance. When respirators are transported, they must be kept in a clean, sanitary place, protected from damage, preferably in a dry and clean plastic locking bag.

IV. Responsibility and Authority

The Warzyn Health and Safety Manager has the responsibility to designate local Warzyn personnel at each branch who have the responsibility of local implementation of the program. Program maintenance implementation and review is the ultimate responsibility of the Warzyn Health and Safety Manager.

It is the intent of this RPP to provide the best possible respiratory protection for hazardous waste site workers. This program has been developed in accordance with the intent of 29 CFR Part 1910.134 CFR Part II, 14, 14a, and ANSI Z88.2 (1980). Its SOP's have been developed to establish a respiratory program that meets current needs, ensures that it will be carried out satisfactorily, and ensures that it will remain effective through continual examination. The program will undergo an annual re-evaluation under the direction of the Warzyn Health and Safety Manager.

Warzyn shall acquire through purchase or lease, all necessary respiratory equipment as specified in this plan. Warzyn will purchase and use only approved respirators. These respirators will in no way be modified by Warzyn or its employees. Modifications of an approved respirator unauthorized by the approving agencies automatically voids the respirator approval.

V. Medical Surveillance

It is the policy of Warzyn that no employee will be assigned to those tasks requiring the use of respirators until that employee has been found to be physically and psychologically fit to wear the designated respirators under working conditions. A physician, designated by Warzyn, will make the determinations as to whether or not the employee is fit to wear the respirator and as to under what restrictions that employee may use the respirator. This medical determination will be made annually, and at other such times as may be deemed necessary.

Guidance for Selection of Approved Respirators for Protection Against HAzardous Atmospheres

OSHA 1910.134 states that respirator shall be selected on the basis of the hazards to which workers are exposed and that ANSI Z88.2 shall be used for guidance in their selection. OSHA also requires that approved or accepted respirators be used when available, based upon 30 CFR Part II, 14, 14a. The selection of respiratory protection equipment for use in response to hazardous waste site work has been guided by considerations of risk to life and health, by the nature of the equipment available, and by relative comfort and ease with which work may be performed while still achieving an

appropriate level of protection. This section will summarize the criteria used for equipment selection and the conditions under which each type of equipment is safe and why.

The selection of the proper type of respiratory protection equipment for Warzyn use in response to hazardous waste site work will be based upon the following criteria:

1. The nature of the hazardous situation encountered;

2. The type of respiratory hazards, including physical properties, physiological effects on the body, concentration of toxic material (or airborne radioactivity level), established permissible time weighted averages for toxic materials, and any established or suspected presence of atmospheres which are immediately dangerous to life and health (IDLH);

3. The location of the hazardous area in relation to the nearest area having acceptable respirable air;

4. The period of time for which respiratory protection must be provided;

5. The activities of Warzyn employees in the hazardous area;

6. The physical characteristics and functional capabilities and limitations of the various types of respirators; and

7. Extenuating local environmental conditions including such factors as temperature, humidity, precipitation, etc.

8. Respiratory protection factors.

When working on a hazardous waste site, an employee will be faced with two possible atmospheric contamination scenarios; unknown atmospheric contamination components and concentrations, and known atmospheric contamination components and concentrations.

A. Unknown Atmospheres

In some instances, it may not be known in advance what toxic or hazardous substance may be present at the work location, the airborne concentration(s) of these substances at the site, or the presence or absence of an oxygen deficient atmosphere. In these instances, it will be assumed that the unknown atmosphere is immediately dangerous to life and health and/or possibly oxygen deficient. In these situations, 29 CFR 1910.134 and ANSI Z88.2 (1980) requires that only positive-pressure, self-contained breathing apparatus (SCBA) will be used.

It is therefore the policy of Warzyn that when employees are working at a site with unknown air contaminant concentrations, Warzyn personnel will use positive- pressure SCBA's. Respiratory protection may be downgraded after the atmosphere has been categorized.

B. Known Atmospheres

There are cases of response activities at either material spills or hazardous waste sites where the contaminants involved are known, the air contaminant concentrations are known and the specific oxygen content of the atmosphere is known. In these situations, the OSHA regulations and ANSI Z88.2 (1980) guidelines, prescribe specifically allowable respiratory protection. The following details respiratory protection which will be provided by Warzyn in such instances.

- Atmospheres which are oxygen deficient (less than 19.5% oxygen). In these atmospheres, OSHA requires that only respirators which provide an independent source of respirable air can be used; i.e., SCBA's, SCBA's with air-line sources, supplied air-line respirators, etc. In instances when an employee knows that an atmosphere is oxygen deficient, then he/she will utilize one of the above mentioned types of respiratory protective equipment as directed by the Warzyn site safety officer.

- Atmospheres which are Immediately Dangerous to Life or Health (IDLH). In atmospheres encountered that contain adequate oxygen but are, as defined in ANSI Z88.2, as being immediately dangerous to life and health because of the presence of toxic contaminants, only respirators which provide an independent source respirable air under positive pressure can be used. In the instance where an employee knows, based upon adequate sample results, that the atmosphere is at the IDLH level, then he/she will use a positive-pressure demand SCBA.

- Atmospheres which are not Immediately Dangerous to Life and Health. In atmospheres encountered that contain adequate oxygen (19.5% oxygen or more), contaminants with good warning properties (taste, smell, irritating) which are not immediately dangerous to life and health due to toxicity, air purifying respirators are acceptable.

NIOSH/MSHA-approved, air-purifying respirators are manufactured in 1/4, 1/2 and full face masks models each having varying advantages and disadvantages. Advantages and disadvantages deal primarily with degree of fit, comfort, and

the possible need for eye protection. All existing data identifies that for the maximum face-to-respirator fit and maximum eye protection, the full face mask, air-purifying respirator is by far the best. This is the style of respirator mask which Warzyn will utilize for its employees.

In the selection of the appropriate air purifying respirator, OSHA requires that a fit testing procedure be used. At a minimum, a qualitative fit test must be run to determine the proper respirator-to-face seal with a negative pressure respirators. The results of this fit test are to be used to select the specific types, makes, and models of negative pressure respirators for use by each employee. Where an employee cannot be fitted properly with the brand of respirator mask routinely utilized by Warzyn, an effort will be made to find an acceptable substitute model or brand.

OSHA also requires that in atmospheres where air purifying respirators are used and the possibility exists for an increase in the levels of toxic contaminates, that an emergency escape mask must be provided for all employees in these situations.

It is, as previously mentioned, the policy of Warzyn that when employees respond to a hazardous waste site where the atmosphere encountered contains adequate oxygen, contaminants with good warning properties, and is not immediately dangerous to life and health because of the presence of toxic contaminants, personnel will use NIOSH/MSHA-approved air-purifying cartridge respirators.

Because of the wide variety of facial characteristics of employees and the wide array of respirator manufacturers, no specific make or model will be issued without a proper fit test of the individual employee. Each employee who will use an air-purifying respirator will go through qualitative fit testing using isoamyl acetate and an irritant smoke. If a proper fit can be obtained using an MSA, then that mask will be issued to the employee, otherwise an alternative brand of mask will be sought which will be effective and properly fit the individual. Once the individual has been issued a properly fit-tested, full face mask air-purifying cartridge respirator, only NIOSH/MSHA-approved cartridges for the selected make and model will be used.

During the use of the selected air-purifying cartridge respirator, all employees will carry an approved emergency escape mask as required by OSHA. This unit is designed to be used only to get the carrier out of a hazardous situation.

In compliance with OSHA 29 CFR Part 1910.134, Warzyn will provide each respirator user a fit test to determine his/her ability to obtain a satisfactory fit with a negative pressure respirator. The results of the fit test will be used to select the specific type, make, and model of negative pressure respirator for use by the wearer.

The following policies will also be adhered to in the fitting and use of the respirators:

- Fit testing for positive-pressure SCPA's is not required as described in ANSI Z88.2 (1980).
- Respirators of any type (air-purifying or positive-pressure demand) SCBA's will not be used by Warzyn employees if a good face-piece-to-face seal cannot be achieved. This means no facial hair or glasses can be worn that will interfere with the attainment of a good seal. Beards are not allowable for individuals performing on-site work during hazardous waste operations.
- Persons requiring glasses to function safely shall be provided with specially mounted inserts inside the full face mask of the air-purifying or SCBA respirators.
- If it is found that an employee cannot obtain a good face piece-to-face seal because of facial or medical characteristics whether with the air- purifying respirator and/or positive-pressure SCBA, that employee will not use and/or enter an atmosphere that requires the use of that equipment.
- A person shall be allowed to use only the specific make(s) and model(s) of full face, air-purifying respirators for which the person has obtained a satisfactory fit as a result of the qualitative fit testing procedures. Under no circumstances shall a person be allowed to use any respirator not previously fit tested if the results of the fit test indicate that the person is unable to obtain a satisfactory fit.

Warzyn's qualitative fit test procedures involve two stages of testing. Stage I involves a simple respirator negative- and positive-pressure sealing check for face piece fit. Stage II involves the exposure of the respirator wearer to a test atmosphere. This will include two separate atmosphere tests to double check the adequate fit of the respirator to the wearer.

Note: During any fit test, the respirator headstraps must be as comfortable as possible. Over-tightening the straps will sometimes reduce or increase face piece leakage, but the wearer may not be able to tolerate the mask for any period of time.

Stage I - Negative Pressure Sealing Checks for Air Purifying Respirators

The wearer can perform this test by himself or herself in the field or office after donning the air-purifying respirator. This test is performed by closing off the inlet opening of the respirator's cartridge(s) by covering with the palm of the hand(s) so that it will not allow the passage of air, inhaling gently, and holding the breath for at least ten seconds. If the face piece collapses slightly and no inward leakage of air into the face piece is detected, it is reasonable to assume that the fit of the respirator to the wearer is satisfactory.

Positive Pressure Sealing Check for Air Purifying Respirators

This test is performed after donning the air purifying respirator. The test is conducted by closing off the exhalation valve and exhaling gently. The fit of a respirator equipped with a face piece is considered to be satisfactory if a slight positive pressure can be built up inside the face piece for at least ten seconds without detection of any outward leakage of air between the sealing surface of the face piece and the respirator wearer's face.

This test is also to be used only as gross determination of fit when the respirator is to be used in relatively toxic atmospheres. This test shall be used just prior to entering any toxic atmosphere.

NOTE: Both the positive and negative pressure sealing checks can be used on the MSA Model 401, SCBA air mask to determine the gross fit characteristics.

Stage II

A person wearing an air-purifying respirator will be exposed to two test agents; isoamyl acetate (an odorous vapor), and an irritant smoke. Our air purifying respirator will be equipped with an air purifying cartridge which effectively removes the test agents from respired air. If the respirator wearer is unable to detect penetration of the test agent in to the respirator, the respirator wearer has achieved a satisfactory fit.

Procedures for the Isoamyl Acetate Test

Isoamyl acetate of banana oil is a chemical which produces a pleasant banana smelling organic vapor. It is an easily detectable odor. The isoamyl acetate fit test will be conducted by using a plastic garbage bag as a test hood. Inside the plastic bag, a piece of cloth saturated with isoamyl acetate is to be attached to the top portion of the bag. This procedure will produce a rough concentration of approximately 100 ppm in the test atmosphere inside the plastic bag. Most people can detect isoamyl acetate at 1 to 10 ppm.

The following isoamyl acetate fit tests will be performed as follows:

1. The wearer puts on the respirator in a normal manner. If it is an air-purifying device, it must be equipped with a cartridge(s) specifically designed for protection against organic vapors.

2. The wearer enters the test enclosure so that the head and shoulders are well inside the bag.

3. If the wearer detects the banana-like odor, he returns to clean air and readjusts the face piece and/or adjusts the headstraps without unduly tightening them.

4. The wearer repeats the second step. If he does not detect the banana-like odor, he is assumed to have obtained a satisfactory fit. If he smells the vapor, an attempt should be made to find the leakage point. If the leak cannot be located, another respirator of the same type and brand should be tried. If this leaks, another brand of respiratory with a face piece of the same type should be tried.

During the test, the subject should make movements that approximate a normal working situation. These may include, but not necessarily limited to, the following:

1. Normal breathing.

2. Deep breathing, as during heavy exertion. This should not be done long enough to cause hyperventilation.

3. Side-to-side and up-and-down head movements. These movements should be exaggerated, but should approximate those that take place on the job.

4. Talking. This is most easily accomplished by reading a prepared text loudly enough to be understood by someone standing nearby.

5. Other exercises may be added depending upon the situation. For example if the wearer is going to spend a significant part of his time bent over at some task, it may be desirable to include an exercise approximating this bending.

The major drawback of the isoamyl acetate test is that the odor threshold varies widely among individuals. Furthermore, the sense of smell is easily dulled and may deteriorate during the test so that the wearer can detect only high vapor concentrations. Another disadvantage is that isoamyl acetate smells pleasant, even in high concentrations. Therefore, the wearer may indicate that the respirator fits, although it may leak. It is important to stress to the wearer that he indicate any detection of odor at all.

Procedures for the Irritant Smoke Test

This qualitative test is similar to the isoamyl test in concept. It involves exposing the respirator wearer to an irritating smoke produced by commercially available smoke tubes. These are sealed glass tubes, approximately 12 centimeters long by 1 centimeter in diameter filled with pumice impregnated with stannic chloride. When the tube ends are broken and air is passed through it, the material inside reacts with the moisture in the air to produce a dense, highly irritating smoke.

As a qualitative means of determining respirator fit, this test has a distinct advantage in that the wearer usually reacts involuntarily to leakage by coughing or sneezing. The likelihood of his giving a false indication of proper fit is automatically reduced. Because this smoke is very irritating, it can cause problems for the test applicators or other persons in the same room. Therefore, it is advisable to have good ventilation in the room where the testing is to be conducted.

The irritant smoke test will be conducted by using a large polyethylene bag as a tent over the breathing space of the employee being tested. A small hole is made in the top portion of the bag so that the irritant smoke can be dispensed into the bag when the test subject has entered the bag.

The air purifying respirator to be used in this test must be equipped with a high efficiency particulate filter cartridge.

The following irritant smoke fit test will be performed as follows:

1. The wearer puts on the respirator normally, taking care not to tighten the headstraps uncomfortably. Once the respirator is on, the subject is to enter the suspended bag so that the head and shoulders are well inside the bag hood.

2. Once the subject is inside the bag, the tester shall begin to add the irritant smoke in small quantities at first, pausing between puffs from the applicator, listening for a reaction.

3. If the wearer detects no leakage, tester may increase the smoke density, still remaining alert to his reactions.

4. At this point, if no leakage has been detected, the wearer may cautiously begin the head movements and exercises mentioned in the isoamyl acetate test. The tester should remain especially alert and be prepared to stop producing smoke immediately and remove the subject from the bag.

5. If leakage is detected at any time, the tester should stop the smoke and let the wearer out of the bag to readjust the face piece or headstrap tension. The tester should then start the test at the second step.

6 If, at the end of all movements and exercise, the wearer is unable to detect penetrations of the irritant smoke into the respirator, the respirator wearer has a satisfactory fit.

7. Remove the subject from the test atmosphere.

Although equipment selection is very important to the success of the Respiratory Protection Plan (RPP), the proper use of this equipment is equally important. Proper use can only be ensured by carefully training employees in the selection, use and maintenance of the provided respiratory equipment. This requirement can only be satisfied by the establishment and implementation of a training program.

Warzyn's training procedures are divided into two phases: Initial respiratory protection training instruction and refresher training sessions. The following is an explanation of each phase of Warzyn's training procedures.

Initial Respiratory Protection Training Instruction

Each employee, upon entry into Warzyn's hazardous waste investigation program, will receive, from a qualified instructor, training which will insure the proper and safe use of the respiratory equipment. The initial training course, a subsection of the required 40 hours initial training course, will present intensive and in-depth instruction. This course will include the following topic areas.

- Regulations and laws concerning use;
- Reasons for the need of respiratory protection;
- Basic respiratory protection practices and equipment;
- Nature, extent and effects of respiratory hazards to which employees may be exposed;
- A general explanation of all available respiratory protection equipment and devices, and their uses and limitations;
- Selection parameters to be followed in choosing appropriate respiratory protection equipment;
- Opportunity for each employee to handle the selected respirators, learn how to don and wear it properly, check its face piece-to-face seal (fit test), wear it in a safe atmosphere, and wear it in a test atmosphere of isoamyl acetate and irritant smoke;
- Explanation of how to perform proper maintenance and storage of the selected respirators; and
- Classroom and operational instruction in how to recognize and cope with emergency respiratory protection requirements during response activities.

Refresher Training Sessions

It is the policy of Warzyn, that all employees who will use the provided respiratory equipment shall receive annual respiratory protection refresher sessions. These sessions will be conducted by designated and qualified health and safety professionals employed by Warzyn. Session frequency is dependent upon specific personnel usage of equipment. In particular, on-site SCBA use will not be permitted unless a refresher course has been attended within the previous three months. All personnel are required to attend at least 8 hours of refresher training yearly, a part of which must cover respiratory protection.

Issuance of Respirators

Warzyn will maintain sufficient quantities of respiratory protective equipment for employee use. Respirator will be issued to employees for the duration of site work where it is required. During that time period, the employee has specific responsibilities for its care, use, and maintenance. Upon return of equipment to the company storeroom, it will be cleaned, maintained and stored until its required future use.

An array of approved particulate, gas and vapor, combination, and high efficiency cartridges will be provided by Warzyn for any brand of respirator which Warzyn makes available to employees.

Respirator Maintenance, Inspection, Cleaning and Storage

An integral part of Warzyn's RPP is the provision of a conscientiously applied program of maintenance with regard to all respiratory equipment to be used by company personnel. It is the responsibility of each local health and safety coordinator to insure that each piece of respiratory apparatus to be used is judiciously inspected for defects before and after each use; cleaned and sanitized after each use; repaired when needed by a qualified individual, and to ensure that each unit is stored properly so that each respirator will retain its original shape and effectiveness.

Cleaning and Sanitization

It is prescribed that each respirator will be cleaned and sanitized after each use. This will be done by the person to whom it has been issued only after having received thorough training in the proper procedure.

The cleaning and sanitizing of the units will be accomplished in the following manner:

1. The apparatus is to be broken down to its components as described in the manufacturer's schematic display which accompanies the unit when purchased. (This step also affords one the opportunity to thoroughly inspect each of the components for any defects, excessive wear and tear, etc.) Destroy and discard any previously used canisters.

2. Thoroughly wash the face piece and mask components in a cleaning and sanitizing solution made up by adding one ounce of powdered MSA Cleaner-Sanitizer to one gallon of warm water (120RF). The components should be scrubbed with a sponge or soft brush to remove dust, dirt, or other contaminants.

3. Thoroughly rinse all component pieces in warm water. (This step is important in that residuals of the cleaning and sanitizing solution can cause dermatitis in some individuals).

4. Dry all components thoroughly, inspect them again for any defects, reassemble the units, and store properly until the next use.

Inspection for Defects

The inspection of the respirator is probably the most important component of the respiratory maintenance program. A conscientious inspection of the unit will identify damaged or malfunctioning components before use in a hazardous atmosphere. It is the policy of Warzyn that all respiratory equipment will be inspected thoroughly before the apparatus is used and during the cleaning process.

The inspection of respiratory equipment will include a check for tightness of all connections, a check of the condition of respirator inlets and outlet coverings, head harness and assembly, valves and connecting tubes; the end-of-service life indicator and shelf life dates on all filters, canisters, and cartridges; and a thorough check of any regulators, alarms and other warning systems. All rubber and elastomeric parts of the respirator will be checked for pliability, proper sealing, and any sign of deterioration. Each air cylinder will be checked likewise to insure its integrity, currency of inspection, and readiness for use.

Maintenance and Repair

It is the policy of WEI that all replacement of parts and the repair of all respiratory apparatus will be performed only by persons properly trained and certified in respirator assembly and correction of defects techniques. Reducing or admission valves and regulators will be returned to the manufacturer or to a trained and certified technician for repair/or adjustment. IT IS STRICTLY FORBIDDEN FOR ANY PART OF THE RESPIRATOR ASSEMBLY TO BE SUBSTITUTED FOR BY ANY OTHER BRAND OR TYPE OR RESPIRATOR PART. TO DO SO WILL INVALIDATE THE APPROVAL OF THE DEVICE AND COULD SIGNIFICANTLY COMPROMISE THE HEALTH/LIFE OF THE USER.

It is the responsibility of a designated Warzyn employee at each local branch office to maintain an up-to-date record of all repairs, adjustment, and replacement of parts noting the date, apparatus make and model, part number, and technician's name.

Storage of Equipment

All respiratory equipment will be stored in such a way as to protect it against dust, sunlight, excessive heat, extreme cold, excessive moisture, damaging chemicals, and mechanical damage. Respirators will be stored individually, not stacked one upon the other or in cramped spaces, to prevent distortion of rubber or other elastomeric parts. Respirators should be stored in plastic bags and readily identifiable as to the individual to whom it has been issued.

Evaluation of Respirator Program Effectiveness

It is the policy of Warzyn in compliance with 29 CFR 1910.134 and ANSI Z88.2, to regularly inspect and re-evaluate the company respiratory program's effectiveness such that all employees involved are being provided with effective respiratory protection. As further assurance of this degree of protection, periodic monitoring of the user will be done. The respiratory program will be evaluated annually by the Warzyn Health and Safety Manager, at which time a written report will be filed; the written operating procedures may be modified, and corrective actions will be taken to abrogate any discovered defects in the program, noting target dates for implementation.

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APPENDIX E

INSTRUMENT CALIBRATIONS

WARZYN

Instrument Calibrations

All environmental monitoring equipment utilized on this project shall be field calibrated at the beginning and end of each days work activities, except where the manufacturer requirements restrict such calibrations to be limited to bench calibrations.

The following pages outlining calibration procedures are directly extracted from the appropriate manufacturer's manuals.

Bedienungsanleitung
Operating Instructions

COMPUR 4100 SD

Monitox HCN

MDA Scientific, Inc.
405 Barclay Blvd.
Lincolnshire, Illinois 60069
Phone: 800-323-2000 (in IL 312/634-2800)
Telex: 72-6399 MDA-USA • Fax: 312-634-1371

Compur-Electronic GmbH

9.85 – 1'

Gasspurenwarnsystem
COMPUR 4100 SD HCN

Das Gasspurenwarnsystem COMPUR 4100 SD HCN besteht aus

Gasdetektor	(Warngerät mit Anzeige)
Gasgenerator	(Prüfgerät)
Konsole	(empfohlenes Zubehör)
Protokollheft	(empfohlenes Zubehör)

Das System ist speziell für die MAK-Wert-Überwachung ausgelegt.

ACHTUNG!
Trotz der stark vereinfachten Bedienung durch den Endbenutzer ist das Monitox 4100 SD für HCN trotzdem ein komplexes Meßgerät, das eine sichere Funktion nur bei sorgfältiger Beachtung dieser Bedienungsanleitung und regelmäßiger Kontrolle durch die für den Einsatz des Gerätes Verantwortlichen gewährleistet. Dies gilt besonders für den regelmäßigen Zellenersatz sowie den täglichen Funktionstest. Das Einstellen der Warnschwellen liegt ebenso ganz in der Verantwortung des Betriebes; COMPUR empfiehlt die strenge Einhaltung der MAK-Werte. Eine Reparatur ist wegen des Ex-Schutzes nur durch den Hersteller zulässig.

Das Gerät wird von COMPUR mit folgenden Einstellwerten ausgeliefert:

Alarmschwellen:
1. bei MAK = 10 ppm HCN
2. bei 2 MAK = 20 ppm HCN

Die Detektorzelle wird bei HCN Konzentrationen über 1000 ppm irreversibel geschädigt. Dadurch geht die Anzeige nicht mehr auf „Null" zurück. In diesen Fällen muß die Zelle ausgetauscht werden.

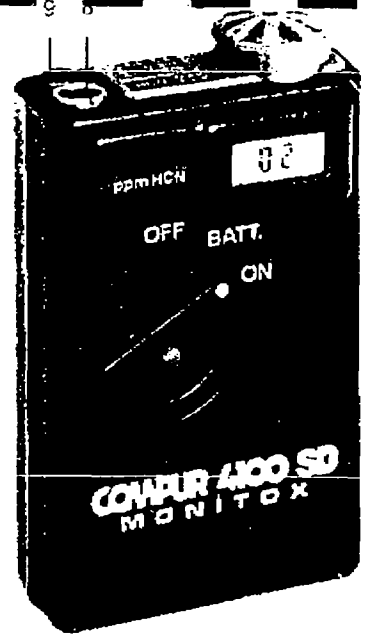
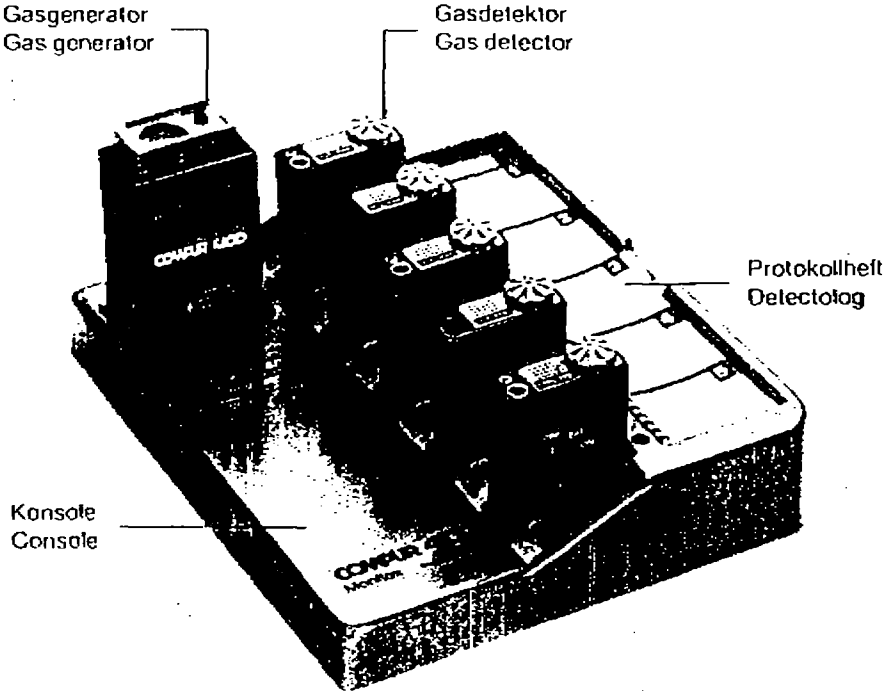


Abb. 1
Picture 1

Abb. 2
Picture 2



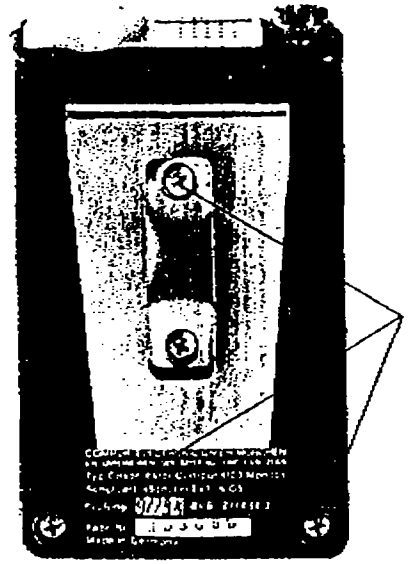


Abb. 3
Picture 3

7 Gehäuseschrauben
8 Dosimeterstecker
9 Ohrhörerstecker

7 housing screw
8 dosimeter plug
9 earphone plug

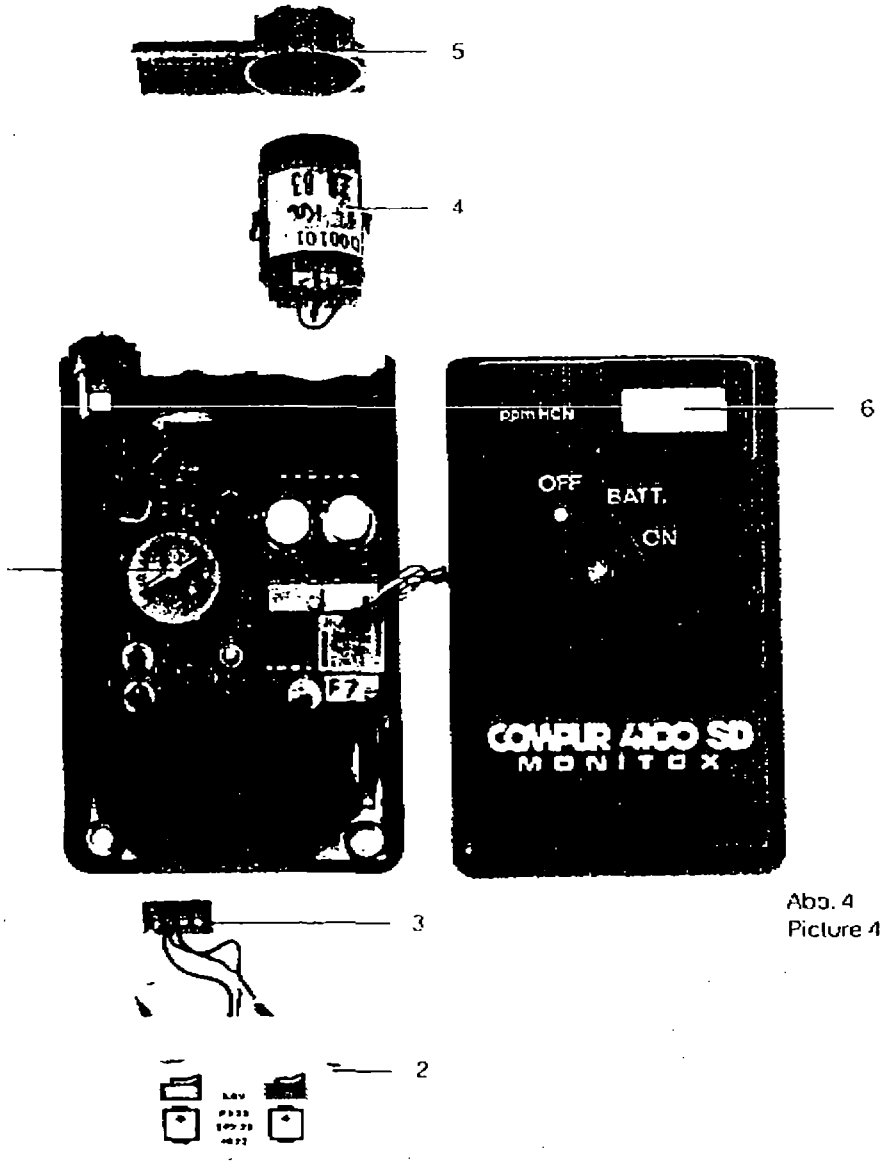


Abb. 4
Picture 4

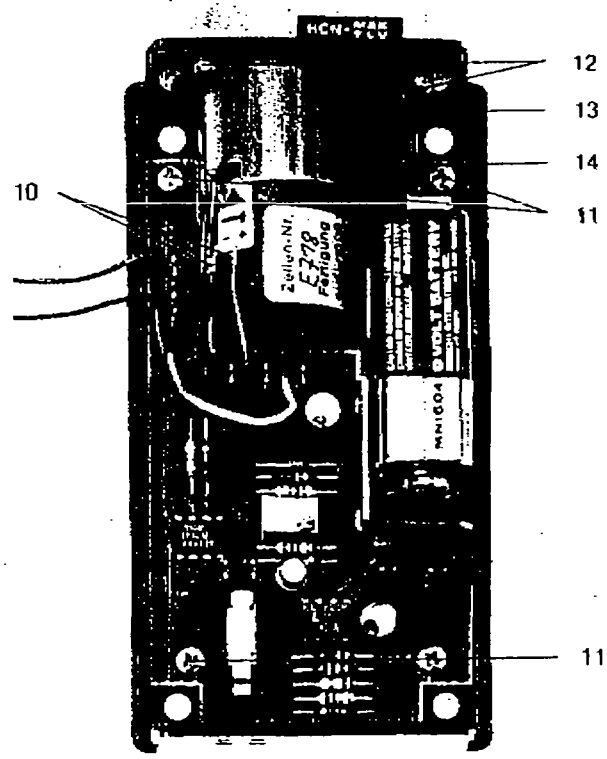


Abb. 5
Picture 5

1 Ein-/Aus-Schalter	1 On-/Off-switch
2 Batteriebehälter	2 battery pack
3 Stecker des Batteriebehälters	3 battery pack connector
4 Detektorzelle	4 detector cell
5 Filterkappe	5 filter cap
6 Display	6 display

10 Lüfteranschlüsse	10 fan leads
11 Leiterplattenschrauben	11 pcb-screws
12 Befestigungsschrauben	12 fan screws
13 Schaltstift	13 switch pin
14 Schalter	14 switch

alibration Instruction for the etector COMPUR 4100 SD lonitox

nhance the intrinsic accuracy of the tector for HCN it is necessary to calibrate e detector either with a HCN nitrogen ixture with definite concentration of HCN make an electronic adjustment by means the COMPUR current generator 5900 023.

1.

ccessories required

1.1.

alibration with gas

calibration cap to place onto Monitox

flow meter

millivoltmeter 0 – 2000 mV; input resistance ≥ 1 MΩ

tubing, set of test cables, screw-driver

calibration gas, known concentration, about 10 ppm HCN in pure N_2

emark: The generation and above all the stability time of HCN calibration gas is not without problems. So if only a small number of detectors are to be calibrated, the electronic method should be prefered.

1.2.

alibration – Electronical Method

icture 6 and 7)

calibration unit (current generator)

millivoltmeter 0 – 2000 mV, nput resistance ≥ 1 MΩ

set of test cables, screw-driver

4.2.

Zero calibration and gain adjustment with calibration gas

4.2.1.

Preparation

The Monitox is opened and positioned with the electronic components upward on a non-slip surface. The cover with the digital display is carefully put aside with the display upward.

Then the unit is switched on via "Batt." position to "ON". The LCD-display should read 00 ppm after several seconds.

The excellent zero-point stability of the cells will normally make unnecessary to adjust the zero-point. Deviations from zero are caused mostly by fault sensor cells.

For zero-checking remove sensor cell.

4.2.2.

Zero-Adjustment

Connect Millivoltmeter to tie down point (MP 2) and GND (MP 1) (picture 6). If the reading is not zero in clean air, and also is not zero without sensor cell, potentiometer (R 9) (offset voltage) has to be varied until the reading is zero.

Note: If reading is zero without cell and not zero with the cell, it may need up to one hour to stabilize the cell. If a cell has been removed for a longer period without short-circuiting the two connectors, the time to stabilize may be up to one day. A new cell therefore has short-circuit on the small pcb, that must be broken away before inserting the cell.

4.2.3.

Gain Adjustment with gas

The special calibration adapter is tightly put onto the dust filter on top of the detector cell.

Adjust a calibration-gas flow through the calibration cap; flow rate should be approx. 100 ccm per minute and the inlet must be the smaller pipe; to avoid pressure variations the outlet should be free of obstacles. After 5 minutes the display of the Monitox has reached its final value.

Connect millivoltmeter to tie down point (MP 2) and GND (MP 1). Depending on the concentration of the calibration gas the following voltage should be displayed: (adjust by means of pot R 7)

$$U = \frac{[c] \text{ in ppm}}{10 \text{ ppm}} \times 80 \text{ mV}$$

The display of the Monitox must show the gas concentration. In the opposite, adjust pot (R 15) until correct reading is shown.

4.2.4.

Gain-Adjustment with the current calibrator

Each detector cell produced by COMPUR is supplied with an indication of the output current at 10 ppm HCN. (Never throw away packings of replacement cells before having noted this indication!!!)

Remove detector cell. Insert calibration cable with the plug board into plug connector for detector cell. The gold contacts must touch the spring contacts. Connect other side of the cable to the current generator.

Make sure of correct polarity of plugs. Switch on generator, turn button till generator display shows output current of detector cell.

Remark: Display always shows actual value of current. If it is zero, check the contacts!

Connect voltmeter to tie down point (MP 2 and GND. Adjust sensibility by means of pot (R 7) until 80 mV is displayed. Monitox must now display 10 ppm. In opposite, adjust pot (R 15).

4.3.

Setting the Alarm thresholds

The alarms of the standard version are to be set on 10 ppm (first alarm 1 TLV) and 20 ppm (second alarm 2 x TLV).

To set the alarm levels, push the 2 mini-switches (S 1) to the right. The display of the Monitox shows now the level of the 1st alarm threshold. This can be adjusted by means of the potentiometer (R 30).

To adjust the 2nd alarm level, push the upper switch to the left. The display shows now the 2nd alarm threshold. This can be adjusted by means of the potentiometer (R 29).

After having adjusted the alarm levels, pust both mini switches to the left. The Monitox display shows now the actual concentratio of HCN.

4.4.

Concluding the adjustment operations

After the settings have been made, turn the switch on the pcb to "OFF"-position. Make sure that the switch-handle on the cover is also in the "OFF"-position. Then carefully replace the cover and fold the connecting cable between pcb and display so that it is neither squeezed in nor cracked. Tighten the screws. The Monitox is now ready for operation.

5.
Maintenance and Servicing Instructions

5.1.
Battery Replacement

1. Turn switch (7) to "OFF".
2. Remove three screws (12).
3. Turn detector over and remove front cover.
   Attention: Do not attempt to remove the cable between front panel and pbc!
4. Lift out battery housing, disconnect plug.
5. Unscrew and remove battery lids. Replace batteries with +pole towards lid. Replace lids.
6. Plug-in battery plug. Ensure cable and cable socket in right position.
7. Replace battery housing and front cover, carefully adjust the cable of the front panel, so that it is not damaged by fixing the front panel; then tighten the screws.
8. Repeat battery test.

5.2.
Filter Cap Replacement

1. Remove screws (7) (picture 4) and open detector.
2. Carefully remove sensor cell together with filter cap (5). Pull cap off cell (4).
3. Attach new filter cap (with identical gas label HCN) and return sensor cell to original position.
   Filter cap order number appears on plate attached to inside of front panel and is listed in section 6.
4. Replace front cover and tighten screws
5. Repeat performance test.

5.3.
Sensor Cell Replacement

1. Open detector (see 5.1.).
2. Remove cell together with filter cap.
3. Remove new cell and filter cap from storage container, pull transparent cap off the cell and replace this by the new filter cap. Correct position of filter cap is shown in illustration.
   Remove short-circuit protection attached to pcb by breaking it away.
4. Proceed current calibration (4.2.4.).
5. Replace sensor cell with filter cap in proper position.
6. Close Monitox.

5.4.
Generator Cell Replacement
(picture 5)

1. Open housing
   (as when replacing battery)
2. Unsolder fan leads (10).
3. Loosen four screws (11) and three screws (12).
4. Remove outlet, gas cell and fan through the front.
5. Carefully insert replacement unit U 5820 300 consisting of outlet, cell and fan and tighten screws (12).
6. Tighten screws (11). Align circuit board so that pin (13) reliably actuates switch (14) when gas detector attached.
7. Resolder fan leads (10).
8. Reassemble generator and tighten screws.
9. Testing: Use properly functioning gas detector for same gas. Switch to "ON", attach. Alarm must sound after about eight seconds.

5.5.
Generator Battery Replacement

Loosen four screws on rear housing panel. Carefully remove front cover. For correct positioning of battery, refer to illustration 5.

5.6.
Troubleshooting

Malfunction	Remedy
Battery test: no response	Replace batteries (5.1.)
Generator test: no response	a) Repeat test using 2nd detector, if no response, b) b) Replace filter cap (5.2.), if not dirty, c) c) Insert new sensor cell (5.3.)
Generator does not supply enough gas	Use moisturizing cap for several days, otherwise replace generator cell (5.4.).
Red LED lights up during test	Replace generator batteries (5.5.).

6.
Accessories and consumables

Part Numbers

1. Gas detector digital display, 2 alarm thresholds with Dosimeter output	U 5306 20
2. HCN cell with filter cap	U 5800 10
3. HCN filter cap (10 pcs.)	U 5810 34
4. Battery PX 23 (1 pc.)	U 4990 00
5. HCN gas generator	U 5390 30
6. HCN generator cell	U 5820 30
7. Calibration gas adapter	U 5900 10
8. Measuring cable: calibration	U 5900 11
9. Digital Voltmeter	U 5900 01
10. Current calibrator	U 5900 02
11. Calibration cable used in connection with current calibrator	U 5900 12
12. Detectolog	U 5900 00
13. Earphone	U 5900 00

SECTION 3

CALIBRATION

3.1 INTRODUCTION

The PI 101 Analyzer is designed for trace gas analysis in ambient air and is calibrated at HNU with certified standards of benzene, vinyl chloride and isobutylene. Other optional calibrations are available (e.g., ammonia, ethylene oxide, H2S, etc.). Calibration data is given in the data sheet. If a special calibration has been done, the data is given in the Application Data Sheet, which notes the sample source, type of calibration (see Section 8, Appendix), and other pertinent information.

Good instrumentation practice calls for calibration on the species to be measured in the concentration range to be used. This procedure assures the operator that the analyzer is operating properly and will generate reliable data.

Some general points to consider when calibrating the PI 101 are that the analyzer is designed for operation at ambient conditions and therefore the gas standards used for calibration should be delivered to the analyzer at ambient temperatures and pressure and at the proper flow rates.

WARNING:

The PI 101 is a non-destructive analyzer; calibrations using toxic or hazardous gases must be done in a hood.

The frequency of calibration should be dictated by the usage of the analyzer and the toxicity of the species measured. If the analyzer has been serviced or repaired, calibration should be done to verify operation and performance. It is recommended that calibration be checked frequently at first (daily or every other day) and then regularly based on the confidence level developed.

The normal meter scaleplate is 0 to 20. If the scaleplate is different, refer to the Application Data Sheet. If there are questions, consult the HNU representative before proceeding with calibration check.

An accurate and reliable method of calibration check is to use an analyzed gas cylinder in a test setup as shown in Figure 3-1 and described below. Additional material on calibration is given in Section 8, Appendix.

3.2 ANALYZED GAS CYLINDER

a. Concentration - The calibration gas cylinder is to contain the species of interest made up in an air matrix at or near the concentration to be analyzed. If the component is unstable in air, another matrix is to be used. The final calibration mixture should be similar to the sample the PI 101 will analyze. If the expected concentration is not known then a concentration should be chosen that will cause a scale displacement of 50 to 80% on the X10 range. Calibration on X10 range will provide accurate values on the X1 range as well.

SECTION 3.2, ANALYZED GAS CYLINDER cont.

For use on the 0-2000 range, a two-standard calibration is preferred: one at 70 to 85% of the linear range and the other at 25 to 35% of the linear range. With the linear range of approximately 600 ppm for most compounds these points would lie between 420 to 510 ppm and 150 to 210 ppm, respectively.

b. Stability - The calibration gas must be stable within the cylinder during the period of use. If the calibration is required in the field, then use of a small cylinder is recommended. In addition, the choice of cylinder material in contact with the gas must be considered (steel, aluminum or teflon). If there are any questions, the operator should request stability and usage information from the gas supplier.

WARNING

Extreme care must be taken in the handling of gas cylinders. Contents are under high pressure. In some cases, the contents may be hazardous. Many gas suppliers will provide data sheets for the mixtures upon request.

c. Delivery - The cylinder containing the calibration mixture must be connected to a proper regulator.

WARNING

Never open the valve on a gas cylinder container without a regulator attached.

Leak test all tank/regulator connections as well as the main cylinder valve to prevent toxic or hazardous materials from leaking into the work area. Care must be taken that the materials of construction of the regulator will not interact with the calibration gas.

One method of sampling the calibration gas is illustrated in Figure 3-1. Connect the cylinder to one leg of the tee, a flow meter to the opposite leg, and the probe to the third leg. The flow meter does not require a valve. If there is a valve, it must be left wide open. the flowmeter is only to indicate excess flow. Adjust the flow from the regulator such that only a little excess flow is registered at the flowmeter.

ECTION 3.2, ANALYZED GAS CYLINDER cont.

This insures that the PI 101 sees the calibration gas at atmospheric pressure and ambient temperature.

d. Usage - Generally, a gas cylinder should not be used below 200-300 psi as pressure effects could cause concentration variations. The cylinder should not be used past the recommended age of the contents as indicated by the manufacturer. In case of difficulty, verify the contents and concentration of the gas cylinder.

e. Alternate means of calibration are possible. For more information, contact the HNU Service Department.

.3 PROBE

a. Identify the probe by the lamp label. If a question exists, disassemble the probe and inspect the lamp. The energy of the lamp is etched into the glass envelope.

b. Connect the probe to the readout assembly, making sure the red interlock switch is depressed by the ring on the connector.

c. Set the SPAN pot to the proper value for the probe being calibrated. Refer to the calibration memo accompanying the probe.

d. Check the Ionization Potential (IP) of the calibration gas to be used. The IP of the calibration gas must be at or below the IP of the lamp.

e. Proceed with the calibration as described in Section 3.4. Check the calibration memo for specific data. If any questions develop, call the HNU representative.

f. NOTE: The 11.7eV lamp has a special cleaning compound. Do not use water or any other cleaning compound with the 11.7 eV lamp. Do not interchange ion chambers, amplifier boards or lamps between probes. (See Section 5.2).

3.4 PROCEDURE

a. Battery check - Turn the function switch to BATT. The needle should be in the green region. If not, recharge the battery.

SECTION 3.4, PROCEDURE cont.

b. Zero set - Turn the function switch to STANDBY. In this position the lamp is OFF and no signal is generated. Set the zero point with the ZERO set control. The zero can also be set with the function switch on the X1 position and using a "Hydrocarbon-free" air. In this case "negative" readings are possible if the analyzer measures a cleaner sample when in service.

c. 0-20 or 0-200 range - For calibrating on the 0-20 or 0-200 range only one gas standard is required. Turn the function switch to the range position and note the meter reading. Adjust the SPAN control setting as required to read the ppm concentration of the standard. Recheck the zero setting (step b.). If readjustment is needed, repeat step c. This gives a two-point calibration; zero and the gas standard point. Additional calibration points can be generated by dilution of the standard with zero air if desired (see Section 8).

d. 0-2000 range - For calibrating on the 0-2000 range, use of two standards is recommended as cited in Section 3.2a. First calibrate with the higher standard using the SPAN control for setting. Then calibrate with the lower standard using the ZERO adjustment. Repeat these several times to ensure that a good calibration is obtained. The analyzer will be appoximately linear to better than 600 ppm, (see Figure 3-2). If the analyzer is subsequently to be used on the 0-20 or 0-200 range, it must be recalibrated as described in steps b. and c. above.

e. Lamp cleaning - If the span setting resulting from calibration is 0.0 or if calibration cannot be achieved, then the lamp must be cleaned (see Section 5.2).

f. Lamp replacement - If the lamp output is too low or if the lamp has failed, it must be replaced (see Section 5.3).

3.5 CALIBRATION CHECKING

Rapid calibration checking in the field can be accomplished by use of a small disposable cylinder containing isobutylene. Immediately after a calibration has been completed, a reading is taken on a special isobutylene standard. This provides a reference concentration measurement for later checking in the field. This can be done at any time with a portable cylinder containing this same special standard, using this reference reading as a check, and making adjustments to the analyzer if necessary. In effect, this is an indirect method of calibration, one maintaining the calibration to give direct readings for the original gas mixture, but using the portable isobutylene cylinder. Details are given in Section 8.2 of the Appendix.

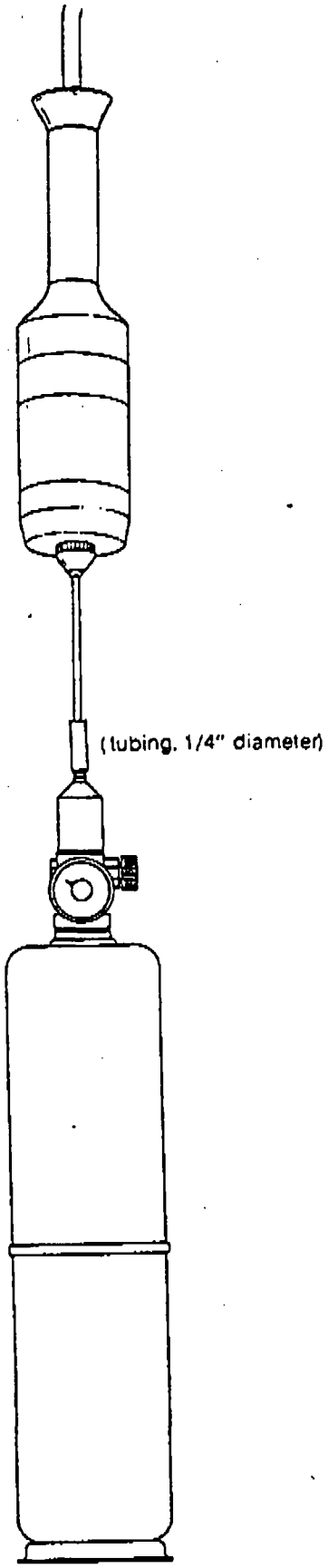
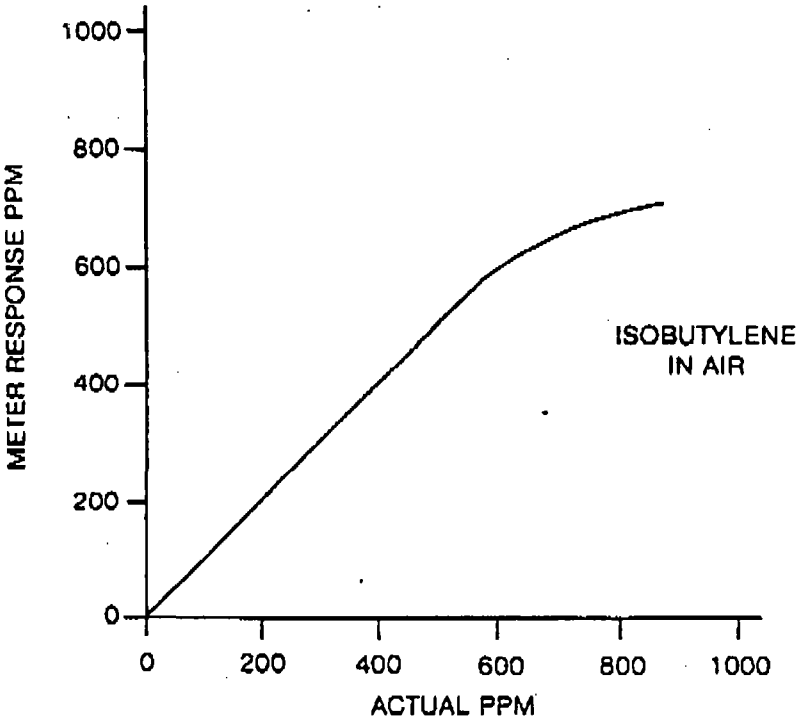


FIGURE 3-1
CALIBRATION TEST SET UP



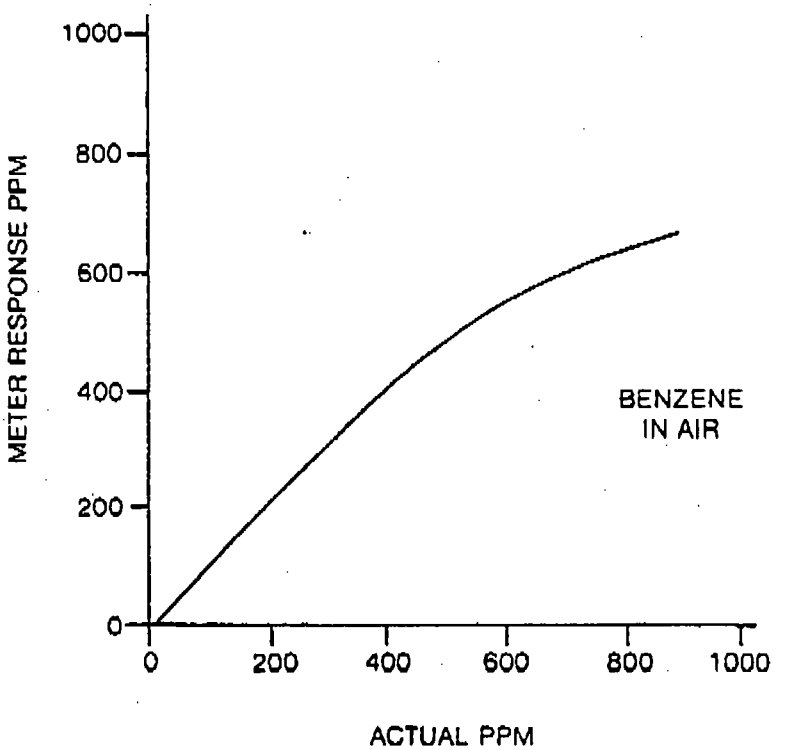


FIGURE 3-2
TYPICAL CALIBRATION CURVES (10.2 eV)